

**A1-F18AC-SRM-310**

15 December 1992

Change 11 - 1 July 2002

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**TECHNICAL MANUAL**

**ORGANIZATIONAL, INTERMEDIATE, AND DEPOT  
MAINTENANCE**

**NONDESTRUCTIVE INSPECTION**

**NAVY MODEL**

**F/A-18A/B/C/D**

**161353 AND UP**

This volume is one of two volumes and is incomplete without A1-F18AC-SRM-300.

This volume contains WP038 00 through WP084 00.

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**NATEC ELECTRONIC MANUAL**

# A1-F18AC-SRM-310

Change 11 - 1 July 2002

Page A

## NUMERICAL INDEX OF EFFECTIVE WORK PACKAGES/PAGES

### List of Current Changes

Original.....0.....15 Dec 92	Change.....1.....1 Apr 93	Change .....2 .....1 Jul 93	Change .....3 .....15 Oct 93
Change .....4 .....15 Feb 94	Change .....5 .....1 Jul 94	Change.....6.....1 Sep 96	Change.....7.....1 Jul 97
Change.....8.....1 May 00	Change.....9.....1 Nov 01	(IRAC 2 Inc.)	
Change .....10 .....1 Feb 02	(IRAC 1 Inc.)	Change .....11 .....1 Jul 02	

Only those work packages/pages assigned to the manual are listed in this index. Insert Change 11, dated 1 July 2002. Dispose of superseded work packages/pages. Superseded classified work packages/pages shall be destroyed in accordance with applicable security regulations. If changed pages are issued to a work package, insert the changed pages in the applicable work package. The portion of text affected in a change or revision is indicated by change bars or the change symbol "R" in the outer margin of each column of text. Changes to illustrations are indicated by pointing hands, change bars, or MAJOR CHANGE symbols. Changes to diagrams may be indicated by shaded borders.

Total number of pages in this manual is 768 consisting of the following:

WP/Page Number	Change Number	WP/Page Number	Change Number	WP/Page Number	Change Number	WP/Page Number	Change Number
Title.....11		6.....0		6.....0		3.....7	
A.....11		7.....0		039 00 reserved.....0		4.....7	
B.....11		8.....0		040 00 reserved.....0		5.....7	
C.....11	038 03			041 00		6.....7	
D.....11	1.....0			1.....0		7.....7	
E blank.....11	2.....0			2.....0		8.....7	
TPDR-1.....11	3.....0			3.....0		046 00 reserved.....0	
TPDR-2 blank.....11	4.....0			4.....0		047 00 reserved.....0	
038 00	5.....0			5.....0		048 00 reserved.....0	
1.....0	6.....0			6.....0		049 00 reserved.....0	
2.....0	038 04			042 00		050 00 reserved.....0	
3.....0	1.....1			1.....7		051 00 reserved.....0	
4.....0	2.....1			2.....7		052 00 reserved.....0	
5.....0	3.....1			3.....7		053 00	
6.....0	4.....0			4.....7		1.....0	
7.....0	5.....0			5.....7		2.....0	
8.....0	6.....0			6.....7		3.....0	
038 01	7.....0			7.....7		4.....0	
1.....1	8.....0			8.....7		5.....0	
2.....1	9.....0			9.....7		6.....0	
3.....1	10.....0			10.....7		054 00	
4.....1	11.....0			11.....7		1.....7	
5.....1	12.....0			12.....7		2.....7	
6.....1	13.....0			13.....7		3.....7	
7.....1	14.....0			14 blank.....7		4.....7	
8.....1	15.....0			043 00		5.....7	
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10.....1	17.....0			2.....0		7.....7	
11.....1	18 blank.....0			3.....0		8.....7	
12.....1	038 05			4.....0		055 00	
13.....0	1.....0			5.....0		1.....1	
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4.....0	4.....0			1.....7		11.....0	
5.....0	5.....0			2.....7		12.....0	

# A1-F18AC-SRM-310

Change 11 - 1 July 2002

Page B

WP/Page Number	Change Number	WP/Page Number	Change Number	WP/Page Number	Change Number	WP/Page Number	Change Number
13.....	0	13.....	0	17.....	0	13.....	4
14.....	0	14.....	0	18.....	0	14 blank .....	4
15.....	0	15.....	0	055 05		059 04	
16.....	0	16.....	0	1.....	10	1.....	0
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28.....	1	28.....	1	3.....	0	2.....	7
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30.....	1	30.....	1	058 00		4.....	7
31.....	1	31.....	1	1.....	0	4A.....	7
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33.....	1	33.....	0	3.....	0	5.....	0
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35.....	0	35.....	0	059 00		7.....	0
36.....	0	36.....	0	1.....	0	8.....	7
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4.....	1	8.....	0	4.....	4	060 01	
5.....	1	9.....	0	5.....	4	1.....	7
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7 blank .....	11	11.....	0	7.....	4	3.....	7
8.....	11	12.....	0	8.....	4	4.....	7
9.....	1	13.....	0	9.....	4	5.....	7
10.....	1	14.....	0	10.....	4	6.....	7
11.....	11	15.....	0	11.....	4	7.....	7
12.....	0	16.....	0	12.....	4	8.....	7

# A1-F18AC-SRM-310

Change 11 - 1 July 2002

Page C

WP/Page Number	Change Number	WP/Page Number	Change Number	WP/Page Number	Change Number	WP/Page Number	Change Number
061 00		9.....7		16.....10		2.....0	
1.....0		10.....7		17.....10		3.....0	
2.....0		069 01		18 blank .....10		4.....0	
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2.....1		069 02		6.....8		4.....2	
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6.....1		4.....2		10.....2		8 blank .....2	
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4.....10		4.....10		10.....0		3.....2	
5.....10		5.....10		11.....0		4.....2	
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4.....7		11.....10		4.....7		10.....0	
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6.....7		13.....10		6.....7		12.....0	
7.....7		14.....10		071 00		13.....0	
8.....7		15.....10		1.....0		14.....2	



# A1-F18AC-SRM-310

Change 11 - 1 July 2002

Page D/(E blank)

WP/Page Number	Change Number	WP/Page Number	Change Number	WP/Page Number	Change Number	WP/Page Number	Change Number
15.....	2	16.....	3	20.....	0	32.....	0
16.....	0	17.....	3	21.....	0		
17.....	0	18.....	3	22 blank .....	0		
18.....	0	19.....	3	078 00 reserved .....	0		
19.....	2	20.....	3	079 00			
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076 00		22.....	3	2.....	0		
1.....	0	23.....	3	3.....	0		
2.....	0	24.....	3	4.....	0		
3.....	0	25.....	3	079 01			
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15.....	3	19.....	0	31.....	0		



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**LIST OF TECHNICAL PUBLICATION DEFICIENCY REPORTS INCORPORATED**

**ORGANIZATIONAL, INTERMEDIATE, AND DEPOT MAINTENANCE**

**NONDESTRUCTIVE INSPECTION**

**This WP supersedes TPDR WP, dated 1 February 2002.**

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1. The TPDRs listed below have been incorporated in this issue.

IDENTIFICATION NUMBER/ QA SEQUENCE NUMBER	LOCATION
39783-02-0084	A-Page



## DEPOT MAINTENANCE

## NONDESTRUCTIVE INSPECTION

## CENTER FUSELAGE BULKHEAD Y488.000, INNER WING LOWER LUG ATTACH POINT FATIGUE CRACKS

## PART NO.74A324206

## Reference Material

Naval Aviation Maintenance Program .....	OPNAVINST 4790.2
Structure Repair, Wing.....	A1-F18AC-SRM-210
Inner Wing Removal and Installation .....	WP025 00
Nondestructive Inspection.....	A1-F18AC-SRM-300
Eddy Current Surface Inspection of Aluminum Alloys .....	WP007 00
Penetrant Method.....	WP004 00
Aircraft Corrosion Control.....	A1-F18AC-SRM-500
Stripping.....	WP007 00
Finish System .....	WP012 00

## Alphabetical Index

Subject	Page No.
Center Fuselage Bulkhead Y488.000, Inner Wing Lower Lug Attach Point .....	1
Backup Inspection Method .....	3
Defects .....	1
Post Inspection Cleaning and Corrosion Control.....	4
Primary Inspection Method .....	1
System Securing.....	4

## Record of Applicable Technical Directives

None

**1. CENTER FUSELAGE BULKHEAD Y488.000, INNER WING LOWER LUG ATTACH POINT.**

2. The center fuselage bulkhead Y488.000, inner wing lower lug attach point (attach point) is machined from 7075 aluminum plate. Installed in the attach point is a force mated copper beryllium bushing. Surface finish is ion vapor deposition (IVD) aluminum and epoxy primer coating.

3. **DEFECTS.** Inspect area around attach point for fatigue cracks, see figures 1 and 3.

4. **PRIMARY INSPECTION METHOD.** Primary inspection method is eddy current.

5. **Personnel Qualifications.** Personnel doing this nondestructive inspection should be qualified and certified to do eddy current inspections per OPNAVINST 4790.2 SERIES, NDI Technicians, NEC 7225/MOS 6044.

6. **Preparation of Aircraft.** No special preparation required.

7. **Access.** Have inner wing removed (A1-F18AC-SRM-210, WP025 00).

## Support Equipment Required

Part Number or Type Designation	Nomenclature
ED520	Eddy Current Flaw Detector, Magnatest
Fabricate, Figure 2	Eddy Current Reference Standard, Aluminum
6193	Multiple Coil Eddy Current Probe, Ideal Specialty Co.
1RR90F-6-1/2	Right Angle Eddy Current Surface Probe, GK Engineer- ing
Fabricate, Figure 4	Wing Attach Lug Eddy Current Probe Guide

## Materials Required

## NOTE

Alternate item specifications or part numbers are shown indented.

Specification or Part Number	Nomenclature
P-D-680, TYPE 2 D 1153	Dry Cleaning Solvent Methyl Isobutyl Ke- tone
MIL-P-83953-2, TYPE 1, CLASS A or B, RED or BLACK	Aircraft Mark ing Pencil
MIL-C-87962, TYPE 1	Cleaning Cloth
MIL-P-8184	Acrylic Plastic, Sheet, Lucite Material, 0.090 Thick

**WARNING**

Dry cleaning solvent and methyl isobutyl ketone are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

**NOTE**

Do not remove bushing.

8. **Preparation of Part.** Clean inspection areas with solvent moistened cloth to make sure inspection areas are free of contamination or foreign material.

9. **Equipment Settings/Standardization/Setup.**

a. For flat open areas around attach point, see figure 1, do ED520 Flaw Detector Setup (WP007 00) except as below:

(1) Use 6193 multiple coil surface probe.

(2) Use aluminum reference standard notch to standardize, see figure 2, detail A.

b. For areas around attach point near edge, radius, or fastener hole, see figure 3, do ED520 Flaw Detector Setup (WP007 00) except use 1RR90F-6-1/2 right angle surface probe and probe guide, see figure 4.

10. **Inspection Procedure.**

a. For flat open areas around attach points see figure 1, do Inspection Procedure (WP007 00) except as below:

(1) Position probe on flat smooth surface in inspection area.

(2) Use BALANCE to set meter needle to 250 microamperes.

**NOTE**

When probe is moved near edge of part, fastener hole, or radius, meter needle may gradually move down scale. If required, use BALANCE to return meter needle to 250 microamperes and scan parallel to edge or radius.

(3) Scan part in directions shown in figure 1. Scan at constant speed, no faster than speed used for standardizing equipment. After each scan, index 3/8-inch 90° to scan direction and repeat until complete area, see figure 1, has been scanned in required directions.

(4) Mark area(s) with aircraft marking pencil where sharp down scale deflection of meter needle indicates a crack.

(5) Use 1RR90F-6-1/2 right angle surface probe and WP007 00 to reinspect all marked areas to more accurately locate defects.

b. For areas around attach point next to edge, radius, or fastener hole, see figure 3, do Inspection Procedure (WP007 00) except use 1RR90F-6-1/2 right angle surface probe and probe guide.

**11. BACKUP INSPECTION METHOD.** Backup inspection method is fluorescent penetrant. Fluorescent penetrant inspection may be used to verify indications detected by primary inspection method. See figure 1.



Penetrant inspection shall not be done at suspect crack indication area, after abrasive material removal such as: grinding, sanding, or polishing. Smearing of material will result and interpretation of crack indication will not be possible.

**12. Personnel Qualifications.** Personnel doing this nondestructive inspection should be qualified and certified to do liquid penetrant inspections per OPNAVINST 4790.2 SERIES, NDI Technicians, NEC 7225/MOS 6044.

**13. Preparation of Aircraft.** Same as primary inspection method.

**14. Access.** Same as primary inspection method.

**Support Equipment Required****NOTE**

Alternate item type designations or part numbers are shown in parentheses.

Part Number or Type Designation	Nomenclature
ZA43 (TT10) (XMA101)	Portable Fluorescent Penetrant Inspection Kit
—	14 × Magnifier
M-16	Black Light

**Materials Required****NOTE**

Alternate item specifications or part numbers are shown indented.

Specification or Part Number	Nomenclature
P-D-680, TYPE 2 D 1153	Dry Cleaning Solvent Methyl Isobutyl Ketone
A-A-883, TYPE 1	Pressure Sensitive Tape, Masking Tape
MIL-P-83953-2, TYPE 1, CLASS A or B, RED or BLACK	Aircraft Marking Pencil
ZZ-G-381, TYPE 1, STYLE, 1 SMALL, MEDIUM, and LARGE	Chemical Gloves, Rubber Gloves
AA1048TY1CL1GRIT 400X9X11	Aluminum Oxide Abrasive Cloth
MIL-C-87962, TYPE 1	Cleaning Cloth

## 15. Preparation of Part.



Mechanical or abrasive finish removal may cause damage to (IVD) coating and corrosion of part.

- a. Have finish system removed from inspection area(s) (A1-F18AC-SRM-500, WP007 00).

### WARNING

Dry cleaning solvent and methyl isobutyl ketone are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

- b. Clean inspection areas with solvent moistened cloth to make sure inspection areas are free of contamination or foreign material.

## 16. Inspection Procedure.

- a. Do a type I, method C fluorescent penetrant inspection (WP004 00).

- b. After removing excess penetrant, spray thin film of developer on inspection surface.

- c. Use black light and 14 × magnifier to view inspection area for cracks.

- d. Evaluate indications, mark location of any defect with aircraft marking pencil and record.

## 17. POST INSPECTION CLEANING AND CORROSION CONTROL.

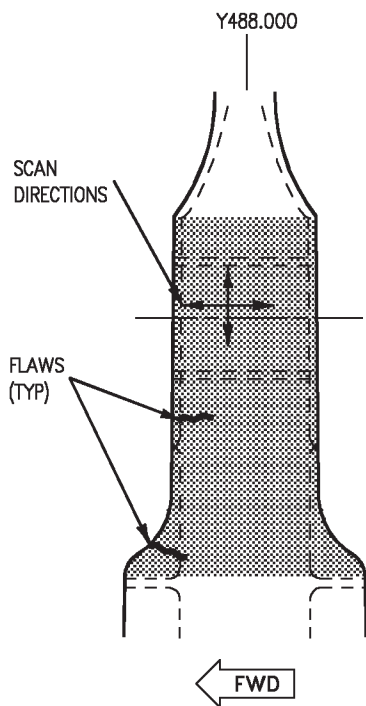
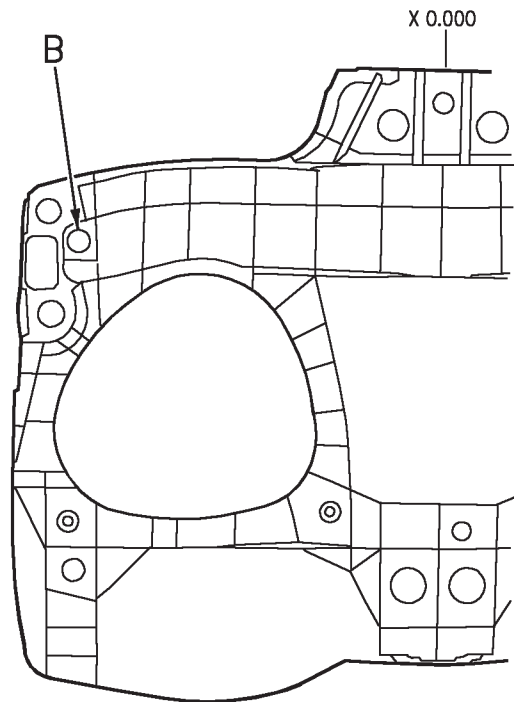
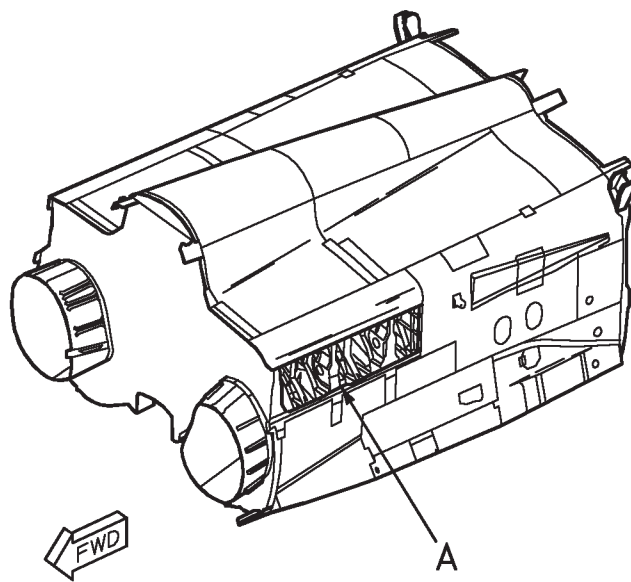
### WARNING

- a. Clean inspection material from part with solvent moistened cloth.

- b. Refinish inspection area (A1-F18AC-SRM-500, WP012 00).

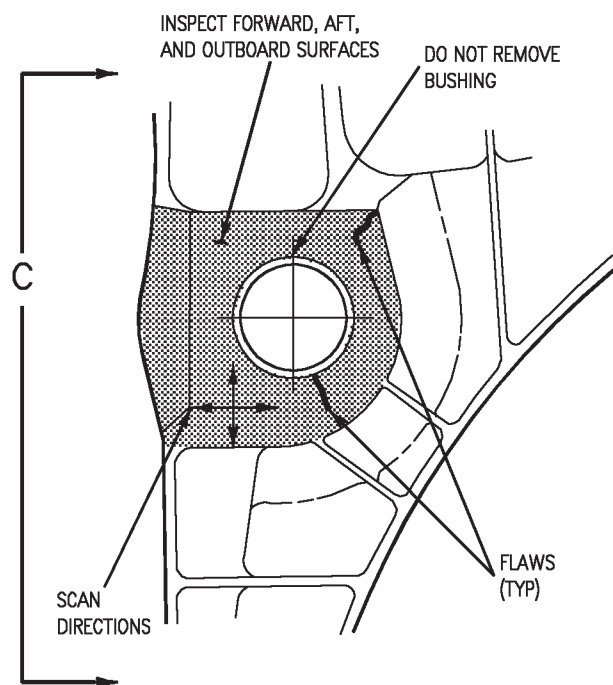
- ## 18. SYSTEM SECURING.
- Have inner wing reinstalled (A1-F18AC-SRM-210, WP025 00).





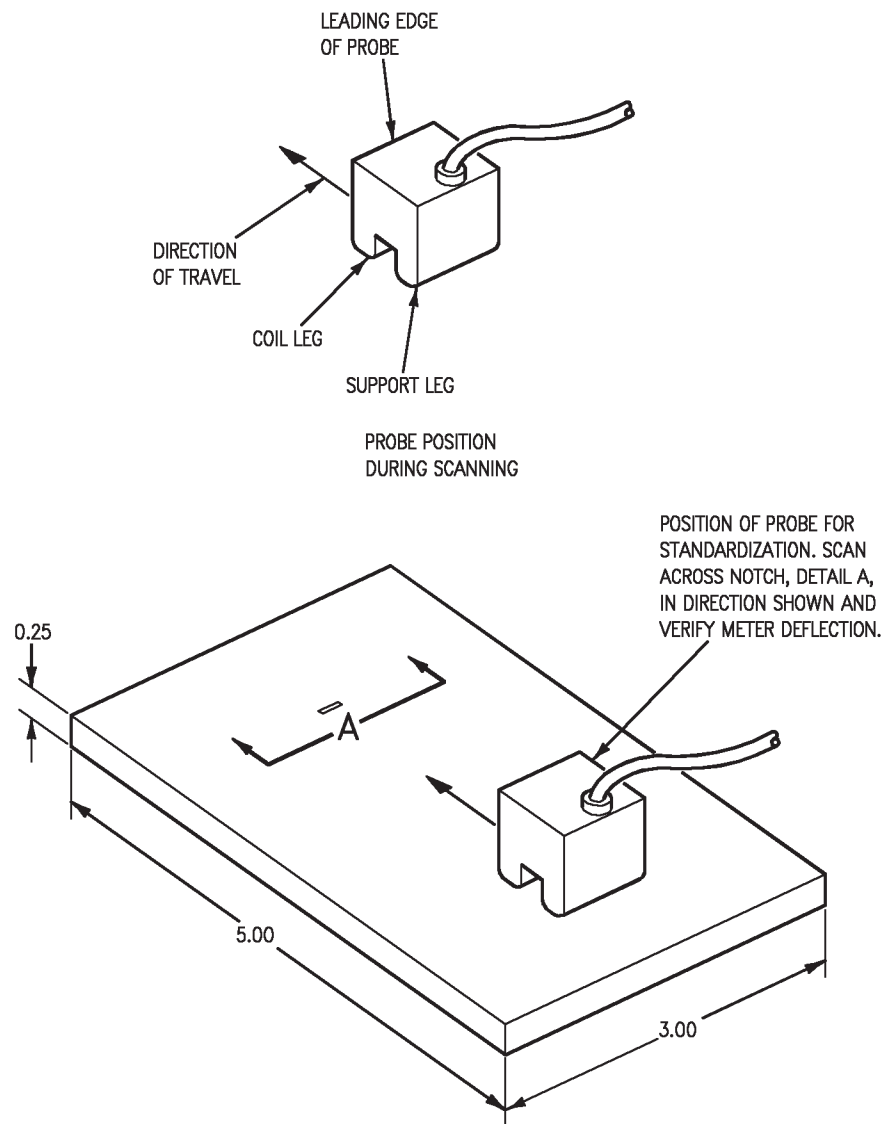
C

LEGEND



B

**Figure 1. Center Fuselage Bulkhead Y488.000, Inner Wing Lower Lug Attach Point; Inspection Areas, Scan Directions, and Typical Flaws**



7075-T6 ALUMINUM REFERENCE STANDARD

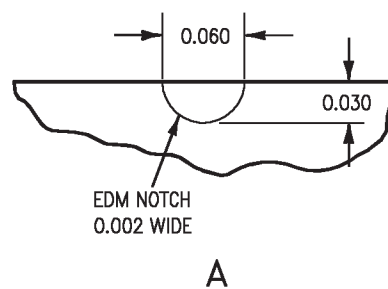
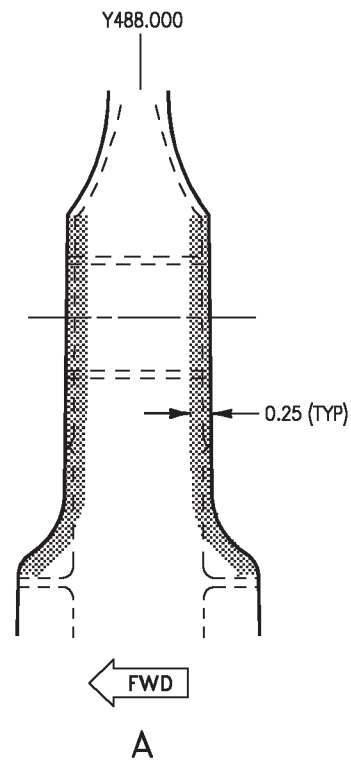
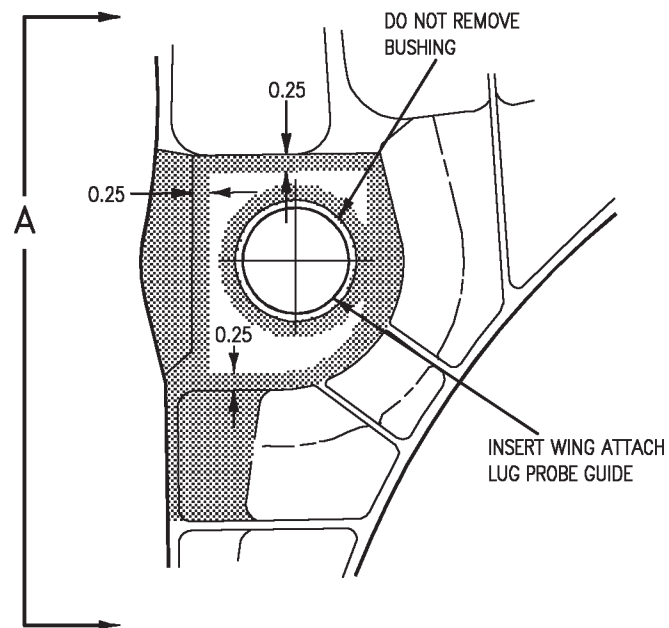


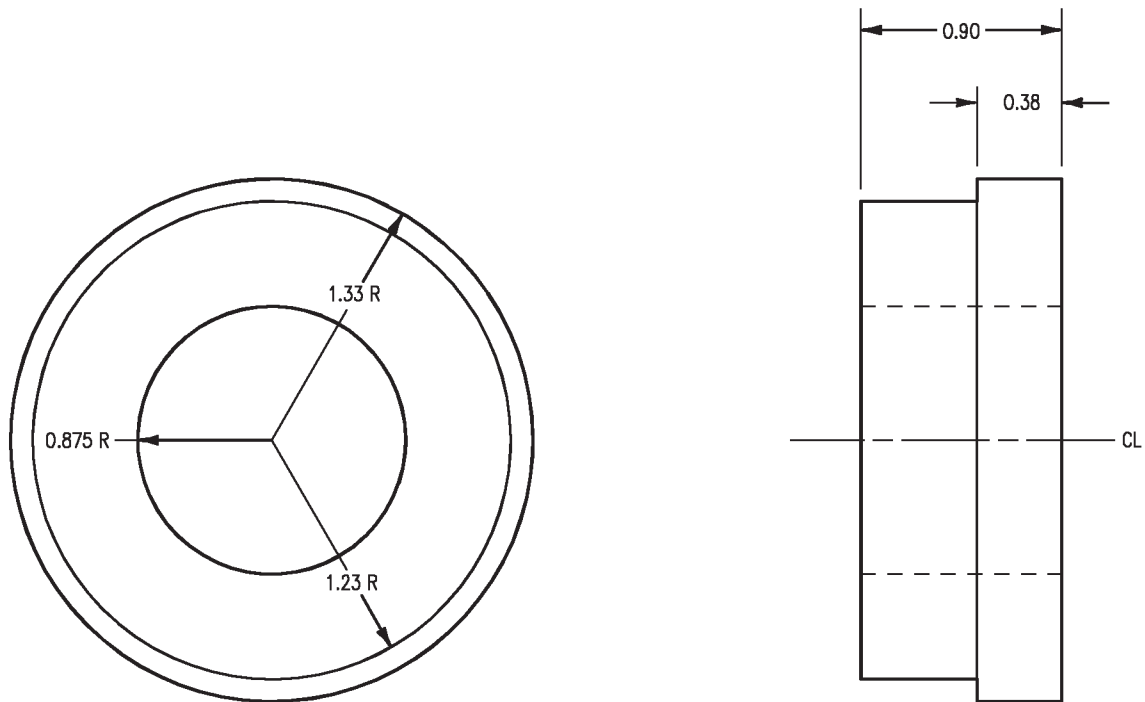
Figure 2. Standardization on EDM Notched Reference Standard



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Figure 3. Right Angle Probe Inspection Area



ACRYLIC PLASTIC

Figure 4. Wing Attach Lug Eddy Current Probe Guide

## INTERMEDIATE MAINTENANCE

## NONDESTRUCTIVE INSPECTION

## CENTER FUSELAGE BULKHEAD Y488.000, FUEL PRESSURE LINE HOLE AREA

## FATIGUE CRACKS AND UNBONDS

PART NO. 74A324206

EFFECTIVITY: 161705 THRU 161719

## Reference Material

Naval Aviation Maintenance Program .....	OPNAVINST 4790.2
Line Maintenance Access Doors .....	A1-F18AC-LMM-010
Piping Installation .....	A1-F18AC-PIM-000
Center Fuselage, Center Tunnel, Door 47 (Right Aft) .....	WP075 00
Secondary Power System .....	A1-F18AC-240-300
APU Accumulator and Start Valve Assembly (2L-P011) .....	WP007 00
Nondestructive Inspection .....	A1-F18AC-SRM-300
Eddy Current Hole Inspection of Aluminum Alloys .....	WP007 01

## Alphabetical Index

Subject	Page No.
Center Fuselage Bulkhead Y488.000, Fuel Pressure Line Hole Area .....	1
Defects .....	1
Eddy Current Method Using ED520 Eddy Current Flaw Detector .....	3
Eddy Current Method Using MXU-713/E Eddy Current Flaw Detector .....	7
Post Inspection, Cleaning and Corrosion Control .....	8
Primary Inspection Methods .....	2
System Securing .....	8
Ultrasonic Method Using C-398 Ultrasonic Flaw Detector .....	2
Ultrasonic Method Using MXU-715/E Ultrasonic Flaw Detector .....	5

## Record of Applicable Technical Directives

None

### 1. CENTER FUSELAGE BULKHEAD Y488.000, FUEL PRESSURE LINE HOLE AREA.

2. Center fuselage bulkhead Y488.000, fuel pressure line hole area is machined from 7075 aluminum plate. Bulkhead is finished with ion vapor

deposition (IVD), aluminum, coating and epoxy primer. Aluminum plates (doublers) are bonded to bulkhead with EA9321 adhesive. Surface finish is conversion coating and epoxy primer.

3. **DEFECTS.** Inspect fuel pressure line hole and in fastener holes for fatigue cracks. Inspect doublers to web for adhesive unbonds, see figure 1.

4. **PRIMARY INSPECTION METHODS.** Primary inspection methods are pulse-echo contact ultrasonics and eddy current.

5. **Personnel Qualifications.** Personnel doing this nondestructive inspection should be qualified and certified to do eddy current and ultrasonic inspections per OPNAVINST 4790.2 SERIES, NDI Technicians, NEC 7225/MOS 6044.

6. **Preparation of Aircraft.** No special preparation required.

7. **Access.**

a. Have doors 42 and 47 removed (A1-F18AC-LMM-010).

b. Have fuel pressure line removed (A1-F18AC-PIM-000, WP075 00).

c. Have APU accumulator assembly removed (A1-F18AC-240-300, WP007 00).

8. **ULTRASONIC METHOD USING C-398 ULTRASONIC FLAW DETECTOR.**

**Support Equipment Required**

**NOTE**

Alternate item type designations or part numbers are listed in parentheses.

Part Number or Type Designation	Nomenclature
C-398 (303B)	Ultrasonic Flaw Detector
57A2271 or EQUIVALENT	Microdot to BNC Connecting Cable
57A2275	0°, 0.375 Dia., 2.25 MHz, Contact Search Unit
57A4244-30	IIW-2 Aluminum Calibration Block

**Materials Required**

**NOTE**

Alternate item specifications or part numbers are shown indented.

Specification or Part Number	Nomenclature
P-D-680, TYPE 2, D 1153	Dry Cleaning Solvent Methyl Isobutyl Ketone
ULTRAGEL II MIL-P-83953-2, TYPE 1, CLASS A or B, RED or BLACK	Couplant Aircraft Marking Pencil
CCC-C-46, TYPE I, CLASS 4	Cleaning Cloth

9. **Preparation of Part**

a. Locate inspection area and visually inspect surfaces. Areas cracked may show accumulation of dirt and soot. See figure 1.

b. Remove sealant around location of fuel tube using plastic scraper. Do not gouge surface when removing sealant. After removal, make sure new surface is smooth without abrupt discontinuities such as chipped paint or primer..

**WARNING**

Dry cleaning solvent and methyl isobutyl ketone, are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

c. Clean inspection area(s) with solvent moistened cloth to make sure inspection area(s) is free of contamination or foreign material.

10. **Equipment Setting/Standardization/Setup For Bonded Aluminum Doublers on Bulkhead.** See figure 2.

a. Connect 57A2275 search unit to Microdot cable.

b. Plug BNC end of microdot cable into ultrasonic flaw detector (tester) T or R BNC jack.

c. Turn tester ON. Allow 15 minutes warm-up.

d. Set tester front face settings:

#### NOTE

Equipment differences may require use of alternate COARSE SWEEP RANGE, FREQ, FINE SWEEP RANGE, DAMPING, and REJECT settings.

#### COARSE SWEEP

RANGE ..... 0.5 INCH

#### ATTENUATORS

OUT ..... 2, 16, and 32

IN ..... 4 and 8

FILTER..... OFF

#### COARSE SWEEP

DELAY ..... 0 - 3 INCHES

FREQ..... 2.25 MHZ

MODE ..... PULSE-ECHO

FINE GAIN..... MAX

REP RATE..... AUTO

#### FINE SWEEP

RANGE..... MIN

DAMPING..... APPROX MID  
SCALE

REJECT..... APPROX O

VIDEO DISPLAY ..... EITHER +,  
-, or FULL  
WAVE

e. With search unit held in the air or face up on work surface, adjust FINE SWEEP DELAY until initial pulse is located at zero on CRT horizontal baseline. See figure 2, CRT 1.

#### NOTE

Initial and echo pulses shown in figure may differ from actual wave shape.

f. Adjust VERT POS if required to set sweep trace coincident with CRT horizontal baseline.

g. Apply couplant and position search unit on surface of 0.75 inch thick area of test block.

h. Adjust FINE SWEEP RANGE, and COARSE SWEEP RANGE if required, so back response is located at 9 on horizontal baseline, and

peak amplitude of 80 to 90 percent of CRT height. See figure 2, CRT 2.

#### 11. Inspection Procedure For Bonded Aluminum Doublers on Bulkhead. See figure 3.

#### NOTE

GAIN may be adjusted by changing FINE GAIN, COARSE GAIN, or by toggling ATTENUATORS.

a. Add 12dB GAIN.

#### NOTE

It may be required to add more than 12dB of gain for thick or porous bondlines.

b. Apply light film of couplant to one doubler, and position search unit on doubler. See figure 3, detail A.

c. Inspect adhesive bond between doublers and bulkhead per substeps below:

(1) Position search unit on doubler having light film of couplant and observe CRT display. See figure 3, CRT 1.

(2) Make sure correct back surface response is received by finger damping. Apply couplant to finger, cotton swab, or pencil eraser, and touch doubler on side opposite search unit, see figure 3, detail A. Amplitude of back surface response will change as doubler is touched on side opposite search unit and finger damped, see figure 3, CRT 2. Amplitude of back surface response will not change when finger damped if unbond exists, see figure 3, CRT 3.

d. Mark all unbonds with aircraft marking pencil and record all areas that indicate adhesive unbonds.

e. Do paragraphs 27 and 28.

#### 12. EDDY CURRENT METHOD USING ED520 EDDY CURRENT FLAW DETECTOR.

## Support Equipment Required

Part Number or Type Designation	Nomenclature
ED520	Eddy Current Flaw Detector, Magnatest
1HCF.2	Bolt Hole Probe, 0.200 inch, Split Collar, Ferrite Shielded, GK Engineering
— Fabricate, Figure 5	Teflon Eddy Current Probe Guide
64002-.190	0.190 Dia. Bolt Hole Probe
S20204	EDM Notch Reference Standard, Aluminum

## Materials Required

## NOTE

Alternate item specifications or part numbers are shown indented.

Specification or Part Number	Nomenclature
P-D-680, TYPE 2 D 1153	Dry Cleaning Solvent Methyl Isobutyl Ketone
MIL-P-83953-2, TYPE 1, CLASS A or B, RED or BLACK	Aircraft Marking Pencil
MIL-C-87962, TYPE 1	Cleaning Cloth
MIL-R-8791	Teflon, Block 2.25 × 2.25 × 1.00

**WARNING**

Dry cleaning solvent and methyl isobutyl ketone, are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

13. **Preparation of Part.** Clean inspection area(s) with solvent moistened cloth to make sure inspection area(s) are free of contamination or foreign material.

14. **Equipment Settings/Standardization/Setup For Fastener Holes.** See figure 1. Do ED520 Flaw Detector Setup (WP007 01) except as below:

- Use 64002-.190, 0.190 diameter bolt hole probe (probe).
- Set FUNCTION to MED for sensitivity adjustment.
- Standardize using applicable hole with 0.060 inch notch in aluminum, EDM notched reference standard to get at least 150 microamperes needle deflection.

15. **Inspection Procedure For Fastener Holes.**

a. Position probe in fastener hole aligning probe coil in center of bulkhead, see figure 4 and substeps below:

(1) Loosen probe collar.

(2) Insert probe into hole while keeping meter needle on scale. Slide probe in and out of hole until maximum meter reading is received.

(3) Tighten probe collar setscrew. Probe coil should now be aligned with center of bulkhead and approximately 0.138 - 0.140 from edge of collar.

b. Rotate probe until maximum meter reading is received.

c. Set meter needle at 250 microamperes.

d. Rotate probe to inspect hole. Typical crack response will cause sharp needle movement down scale exceeding 100 microamperes.



e. Mark all suspect flaw indications with aircraft marking pencil.

f. Record defects.

**16. Equipment Settings/Standardization/Setup For Fuel Pressure Line Hole.** See figure 1. Do ED520 Flaw Detector Setup (WP007 01) except as below:

a. Use 3/16 inch ferrite shielded bolt hole probe.

b. Set FUNC MODE to MED for sensitivity adjustment.

c. Standardize using 0.060 inch notch on EDM notched reference standard to get at least 150 microamperes needle deflection.

d. Insert probe into probe guide, see figure 5, directing probe coil outward and approximately 0.14 inch from coil center to bottom seat edge, see figure 6.

e. Adjust two teflon tipped setscrews allowing only teflon tip of screw to protrude from probe guide, see figure 6.

**17. Inspection Procedure For Fuel Pressure Line Hole.**

a. Position probe and probe guide in fuel pressure line hole, see figure 7.

b. Set meter needle to 250 microamperes.

c. Rotate probe until maximum meter reading is received.

d. Reset meter needle to 250 microamperes.

e. Slowly rotate probe guide to inspect hole. Typical crack responses will cause sharp needle deflection down scale exceeding 100 microamperes.

f. Mark all suspect flow indications with aircraft marking pencil.

g. Record all defects.

h. Do paragraphs 27, and 28.

## 18. ULTRASONIC METHOD USING MXU-715/E ULTRASONIC FLAW DETECTOR.

### Support Equipment Required

Part Number or Type Designation	Nomenclature
1642AS100-1	Ultrasonic Flaw Detector, MXU-715/E, Magnaflux
57A2271 or EQUIVALENT 57A2275	Microdot to BNC Connecting Cable 0°, 0.375 Dia., 2.25 MHz, Contact Search Unit
57A4244-30	IIW-2 Aluminum Calibration Block

### Materials Required

#### NOTE

Alternate item specifications or part numbers are shown indented.

Specification or Part Number	Nomenclature
P-D-680, TYPE 2, D 1153	Dry Cleaning Solvent Methyl Isobutyl Ke- tone
ULTRAGEL II MIL-P-83953-2, TYPE 1, CLASS A or B, RED or BLACK	Couplant Aircraft Marking Pencil
CCC-C-46, TYPE I, CLASS 4	Cleaning Cloth

## 19. Preparation of Part.

a. Locate inspection area, see figure 1.

b. Visually inspect surfaces. Areas cracked may show accumulation of dirt and soot. .

c. Remove sealant around location of fuel tube using plastic scraper. Do not gouge surface when removing sealant. After removal, make sure new surface is smooth without abrupt discontinuities such as chipped paint or primer.

## WARNING

Dry cleaning solvent and methyl isobutyl ketone, are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

d. Clean inspection area with solvent moistened cloth to make sure inspection area is free of contamination or foreign material.

### 20. Equipment Setting/Standardization/Setup For Bonded Aluminum Doublers on Bulkhead.

See figure 8.

- a. Connect 57A2275 search unit to Microdot cable.
- b. Plug BNC end of microdot cable into ultrasonic flaw detector (tester) T or R BNC jack.
- c. Turn tester ON. Allow 15 minutes warm-up.
- d. Set tester front face settings:

## NOTE

Tester settings listed are given as initial setup guide. Equipment differences may require use of alternate REP. RATE, DAMP., FREQ., GAIN, REJECT, and HORIZONTAL SWEEP DELAY and LENGTH.

REP. RATE.....	AUTO
VOLT .....	FULL
DAMP .....	MIN.
FREQ.....	2.25 MHz
MODE .....	ECHO
GAIN (dB) .....	(49dB)
COURSE GAIN .....	4
FINE GAIN .....	9
VIDEO	
FILTER.....	3
MODE .....	F.W.
REJECT.....	0
SYNC.....	REP. REP.

HORIZONTAL	
SWEEP DELAY	
COURSE.....	5
FINE.....	9
HORIZONTAL	
SWEEP LENGTH	
COURSE.....	1
FINE.....	7
POLARITY.....	OFF
DISTANCE ECHO	
CORRECTION.....	OFF

e. With search unit held in the air or face up on work surface, adjust HORIZONTAL SWEEP FINE DELAY until initial pulse is located at zero on CRT horizontal baseline. See figure 2, CRT 1.

## NOTE

Initial and echo pulses shown in figure may differ from actual wave shape.

f. Adjust VERT POS if required to set sweep trace coincident with CRT horizontal baseline.

g. Apply couplant and position search unit on surface of 0.75 inch thick area of test block.

h. Adjust HORIZONTAL SWEEP FINE LENGTH, and COARSE LENGTH, if required, so back response is located at 9 on horizontal baseline, and peak amplitude of 80 to 90 percent of CRT height. See figure 2, CRT 2.

### 21. Inspection Procedure For Bonded Aluminum Doublers on Bulkhead.

See figure 9.

- a. Add 12dB GAIN.

## NOTE

It may be required to add more than 12dB of gain for thick or porous bondlines.

b. Apply light film of couplant to one doubler, and position search unit on doubler. See figure 3, detail A.

c. Inspect adhesive bond between doublers and bulkhead per substeps below:

(1) Position search unit on doubler having light film of couplant and observe CRT display. See figure 3, CRT 1.

(2) Make sure correct back surface response is received by finger damping. Apply couplant to finger, cotton swab, or pencil eraser, and touch doubler on side opposite search unit, see figure 3, detail A. Amplitude of back surface response will change as doubler is touched on side opposite search unit and finger damped, see figure 3, CRT 2. Amplitude of back surface response will not change when finger damped if unbond exists, see figure 3, CRT 3.

d. Mark all unbonds with aircraft marking pencil and record all areas that indicate adhesive unbonds.

## 22. EDDY CURRENT METHOD USING MXU-713/E EDDY CURRENT FLAW DETECTOR.

### Support Equipment Required

Part Number or Type Designation	Nomenclature
NDT 25N Nortec MXU-713/E Nortec 9505955	Programmable Eddyscope NDT 25N Accessory Kit
1-HC-3/16 or EQUIVALENT	Absolute Bolt Hole Probe 3/16 Dia., 500 kHz, Ferrite Shielded, 2 Req'd
—	Probe Guide, Eddy Current Teflon
Fabricate, Figure 5 SH-7050-17 or EQUIVALENT 57A2271	Aluminum Notched Reference Standard Microdot to BNC Connecting Cable, 2 Req'd)

### Materials Required

#### NOTE

Alternate item specifications or part numbers are shown indented.

Specification or Part Number	Nomenclature
P-D-680, TYPE 2, D 1153	Dry Cleaning Solvent Methyl Isobutyl Ketone
ULTRAGEL II MIL-P-83953-2, TYPE 1, CLASS A or B, RED or BLACK	Couplant Aircraft Marking Pencil
CCC-C-46, TYPE 1, CLASS 4	Cleaning Cloth

## 23. Preparation of Part.

#### WARNING

Dry cleaning solvent and methyl isobutyl ketone are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from flames or other sources of ignition.

a. Clean inspection area(s) with solvent moistened cloth to make sure inspection area is free of contamination or foreign material.

## 24. Equipment Settings/Standardization/Setup For Fastener Holes and Fuel Pressure Line Holes.

Do equipment settings/standardization/setup (WP007 01) and as below:

- Use standardization of absolute probes.
- Use two 1-HC-3/16 probes.
- Use SH-7075-17 reference standard.
- Use frequency of 200 kHz.

25. **Inspection Procedure For Fastener Holes.** Do inspection of two fastener holes (WP007 01).

## 26. Inspection Procedure For Fuel Pressure Line

**Hole.** Do inspection of fuel pressure line hole (WP007 01) and as below:

a. Insert probe into probe guide directing probe coil outward and approximately 0.14 inch from coil center to bottom seat edge, see figure 6.

b. Adjust two teflon tipped setscrews allowing only teflon tip of screw to protrude from probe guide, see figure 6.

c. Position probe and probe guide into fuel pressure line hole, see figure 7.

## 27. POST INSPECTION CLEANING AND CORROSION CONTROL.

### WARNING

Dry cleaning solvent and methyl isobutyl ketone are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from flames or other sources of ignition.

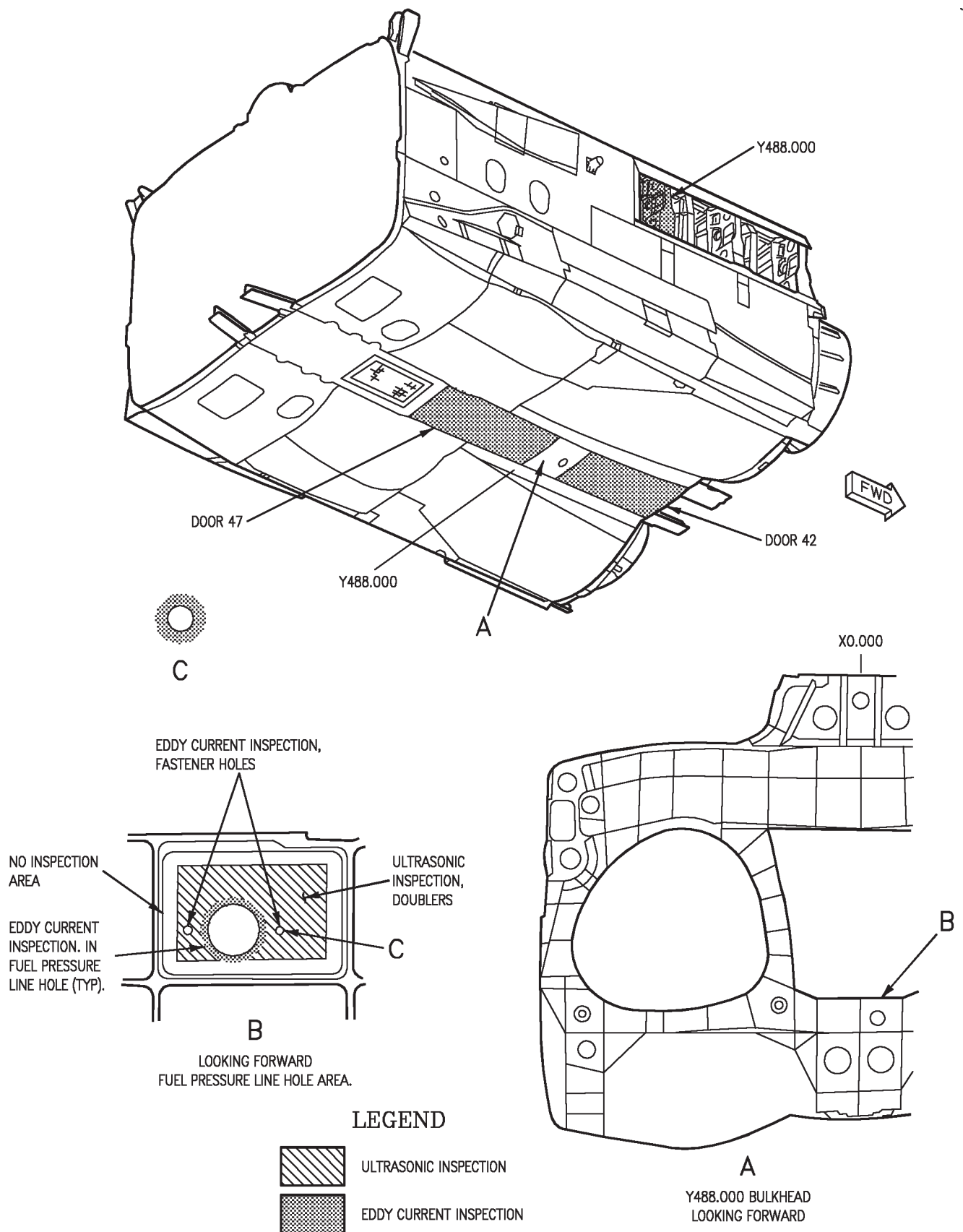
a. Clean couplant and markings from inspection areas using cleaning cloth moistened with solvent.

## 28. SYSTEM SECURING.

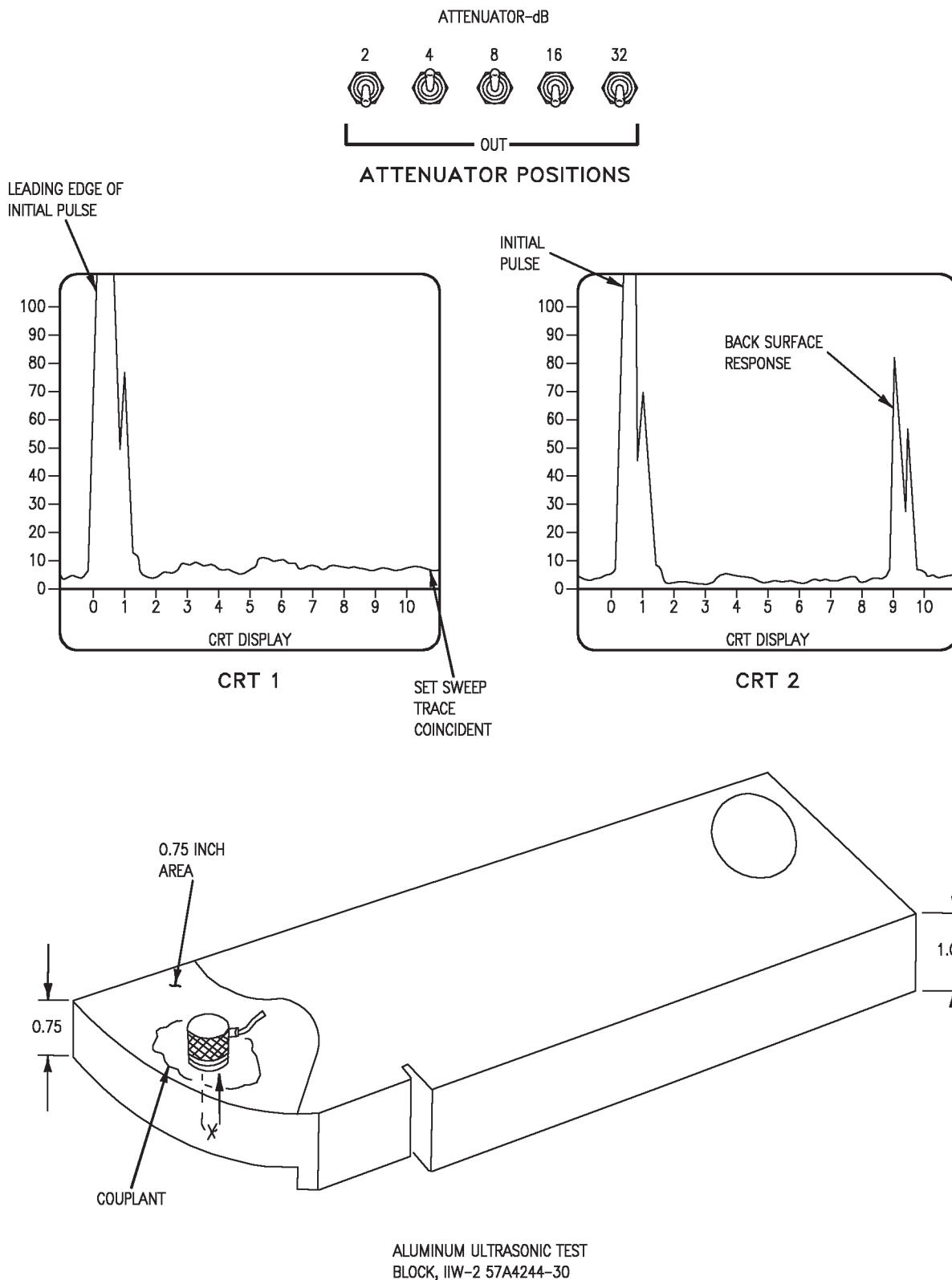
a. Install APU accumulator assembly (A1-F18AC-240-300, WP007 00).

b. Install fuel pressure line (A1-F18AC-PIM-000, WP075 00).

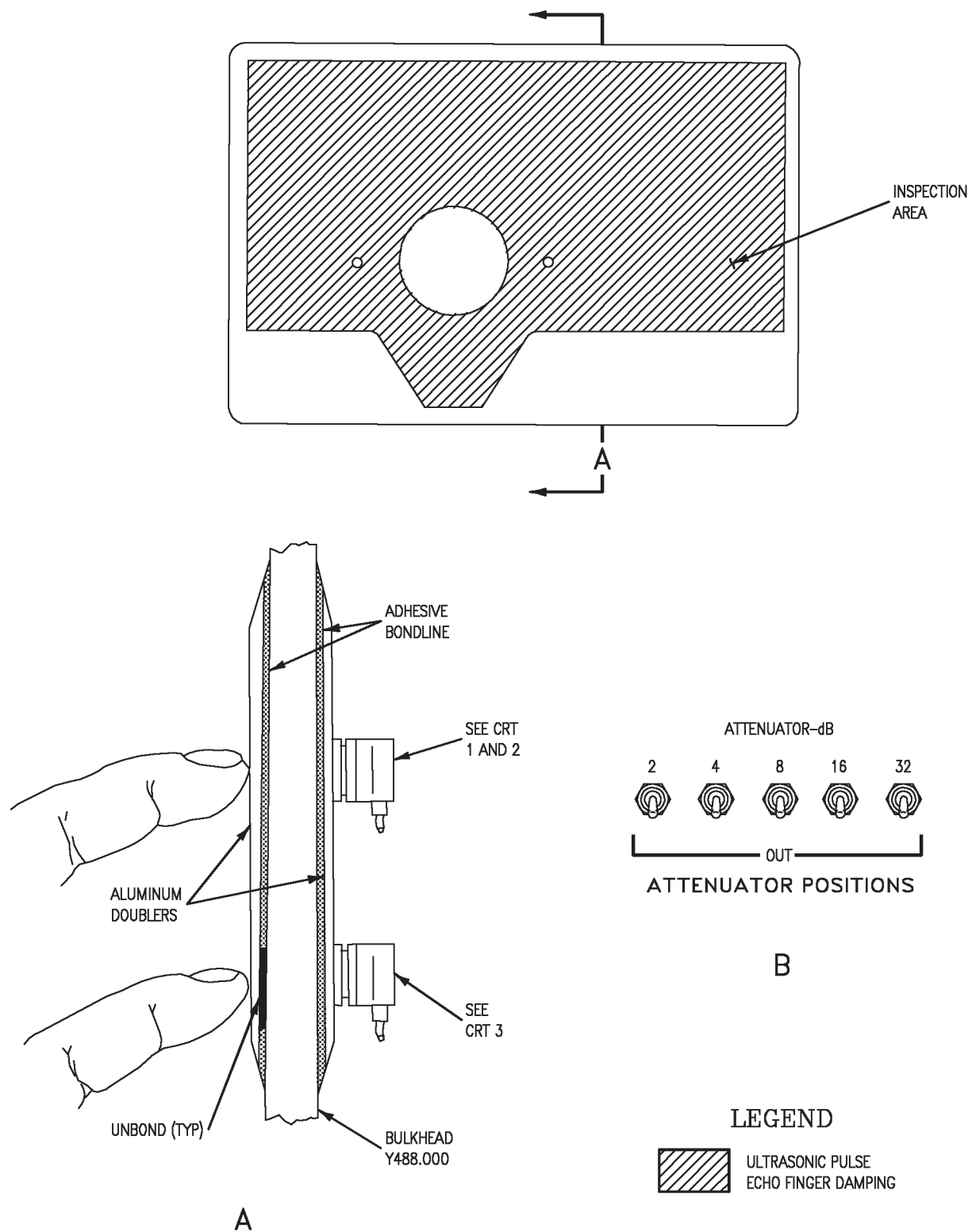
c. Install doors 42 and 47 (A1-F18AC-LMM-010).



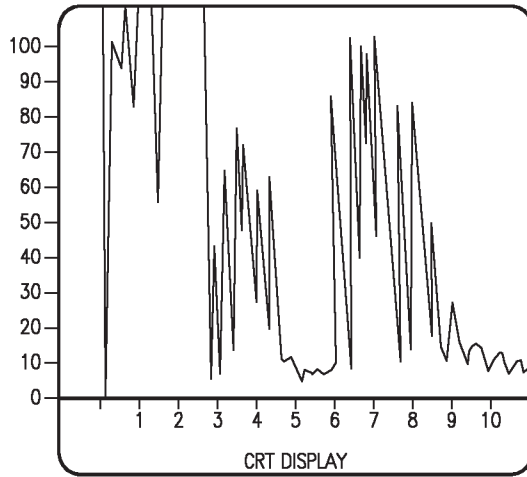
**Figure 1. Location of Bulkhead Y488.000 and Inspection Areas**



**Figure 2. Equipment Standardization Using C-398 Ultrasonic Flaw Detector**

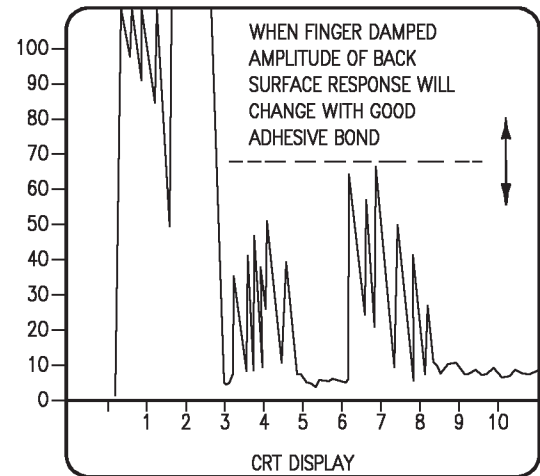


**Figure 3. Inspection Procedure for Bonded Aluminum Doublers on Bulkhead, Using C-398 Ultrasonic Flaw Detector (Sheet 1)**



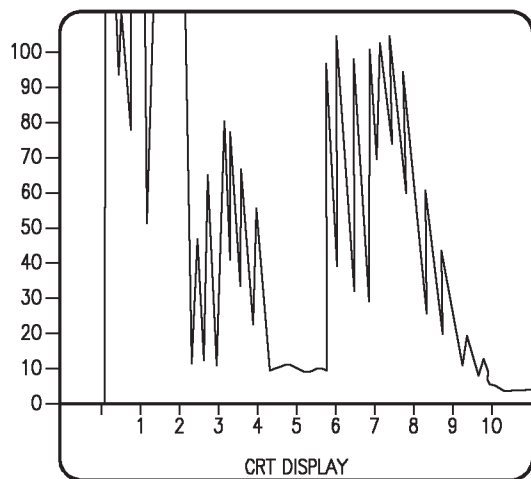
TYPICAL ADHESIVE BOND  
WITH 12dB GAIN ADDED

CRT 1



GOOD BOND  
GIVES AMPLITUDE  
CHANGE

CRT 2



WHEN FINGER DAMPED,  
AMPLITUDE OF BACK  
SURFACE RESPONSE  
WILL NOT CHANGE WITH  
ADHESIVE UNBOND.

CRT 3



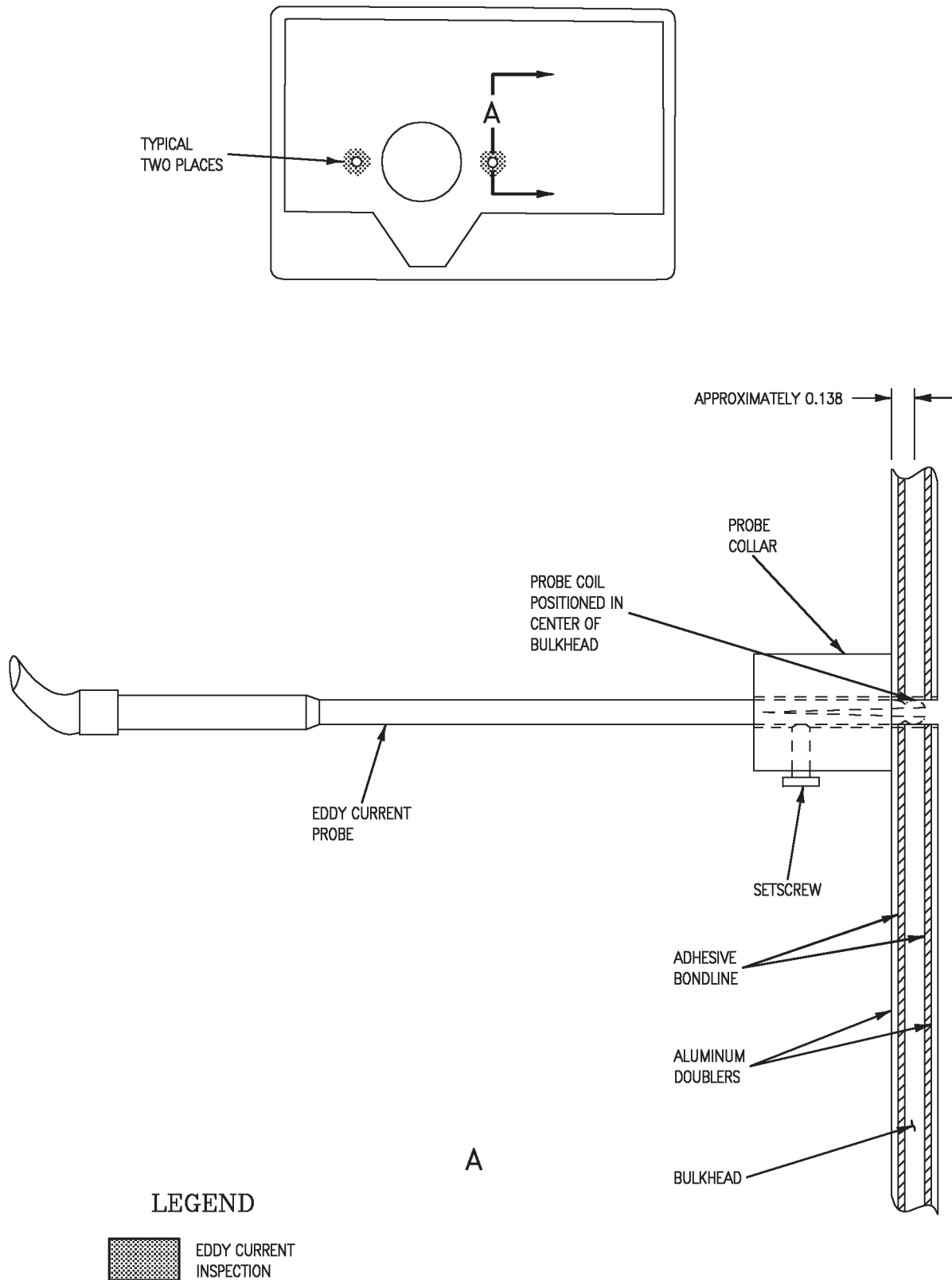


Figure 4. Probe Alignment in Fastener Hole

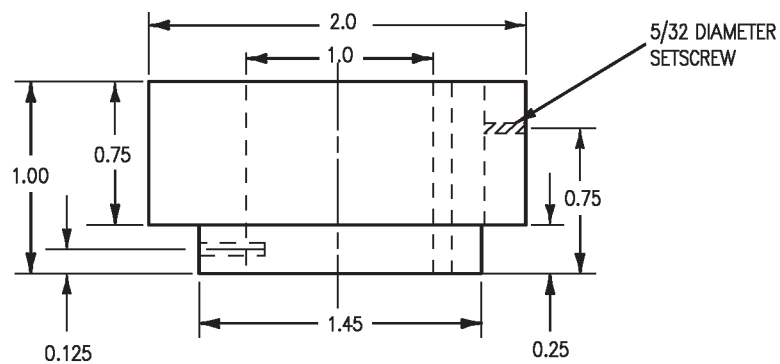
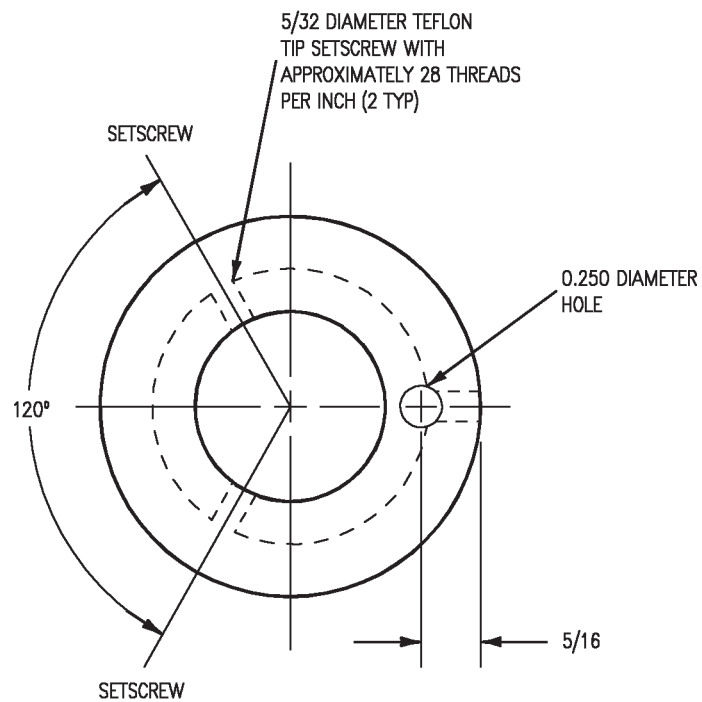


Figure 5. Teflon Eddy Current Probe Guide

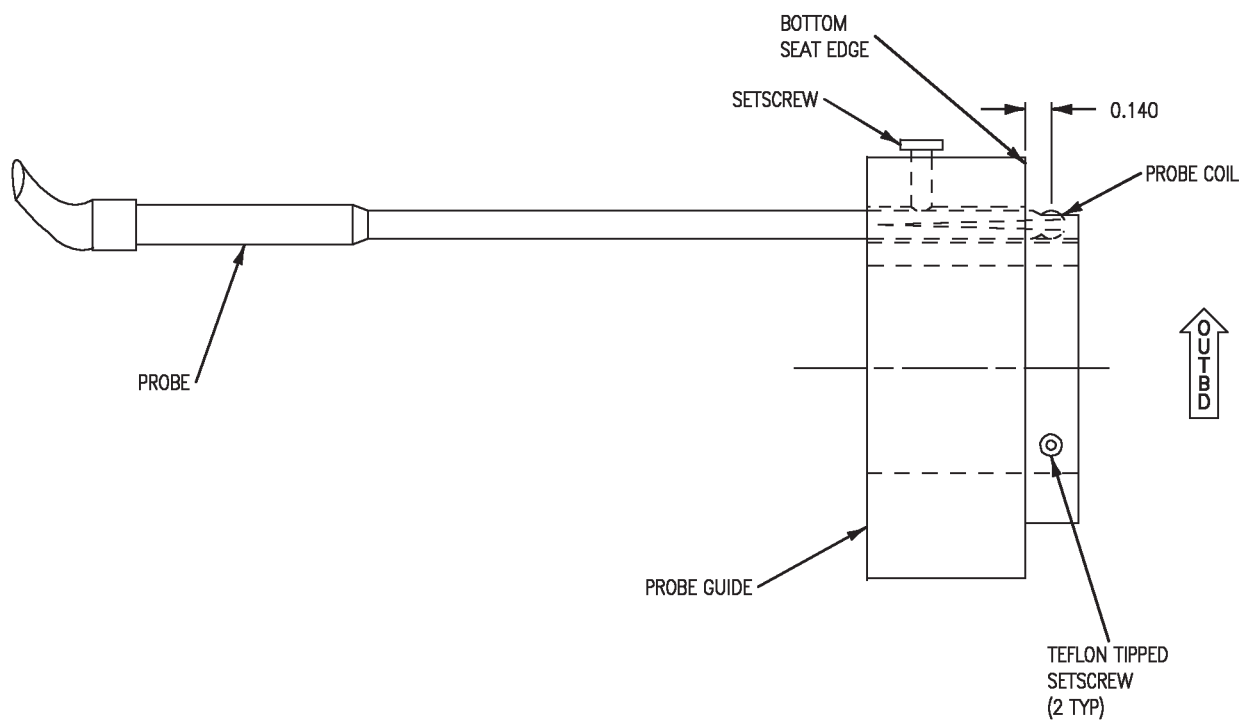


Figure 6. Probe/Probe Guide Adjustment, Setup

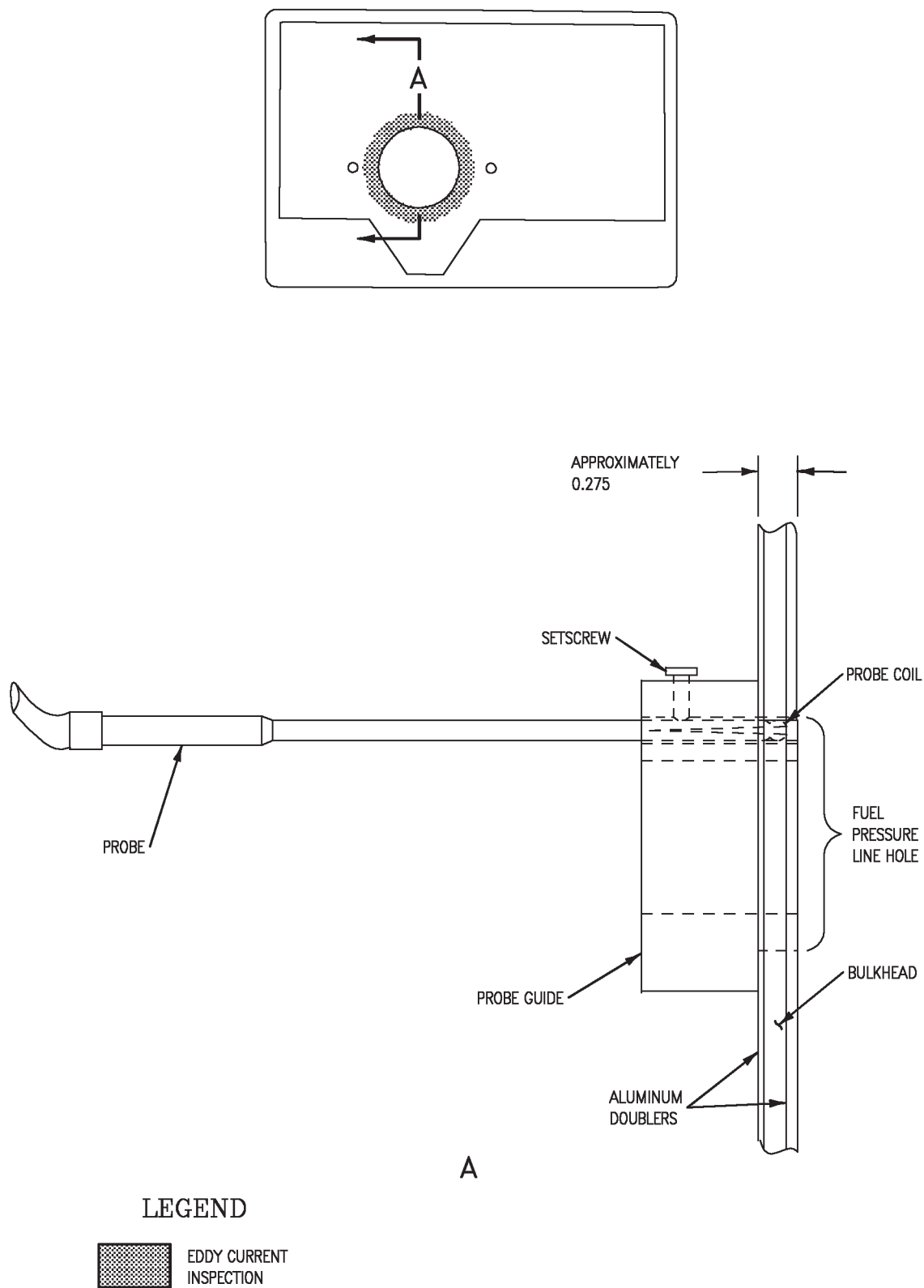
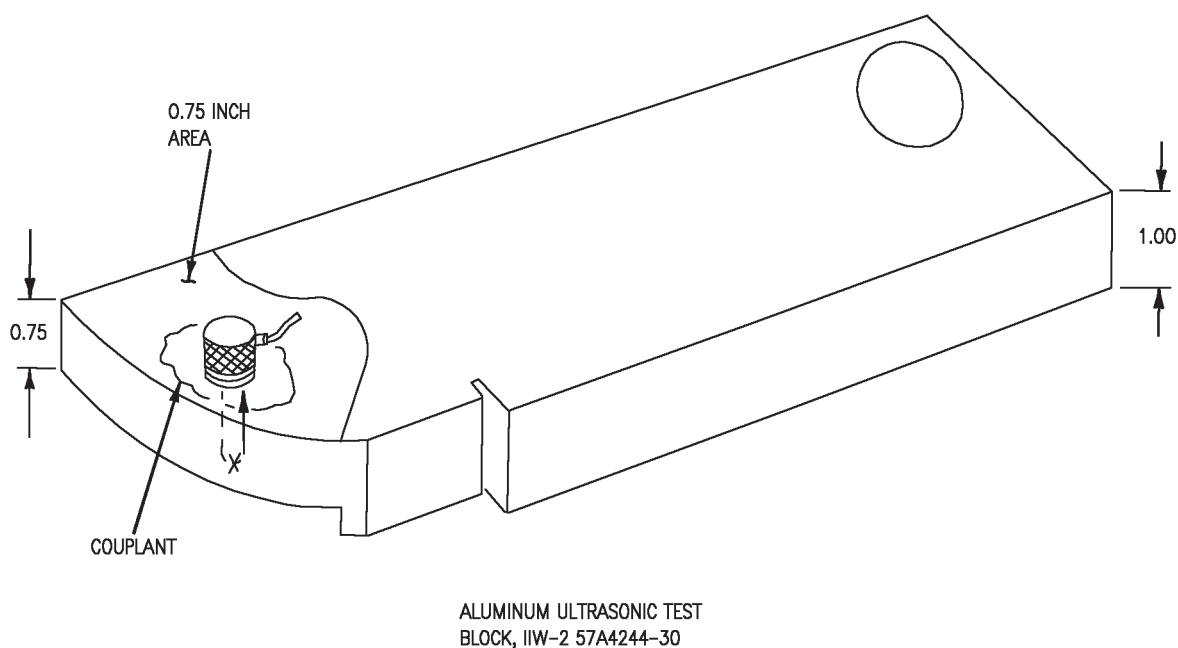
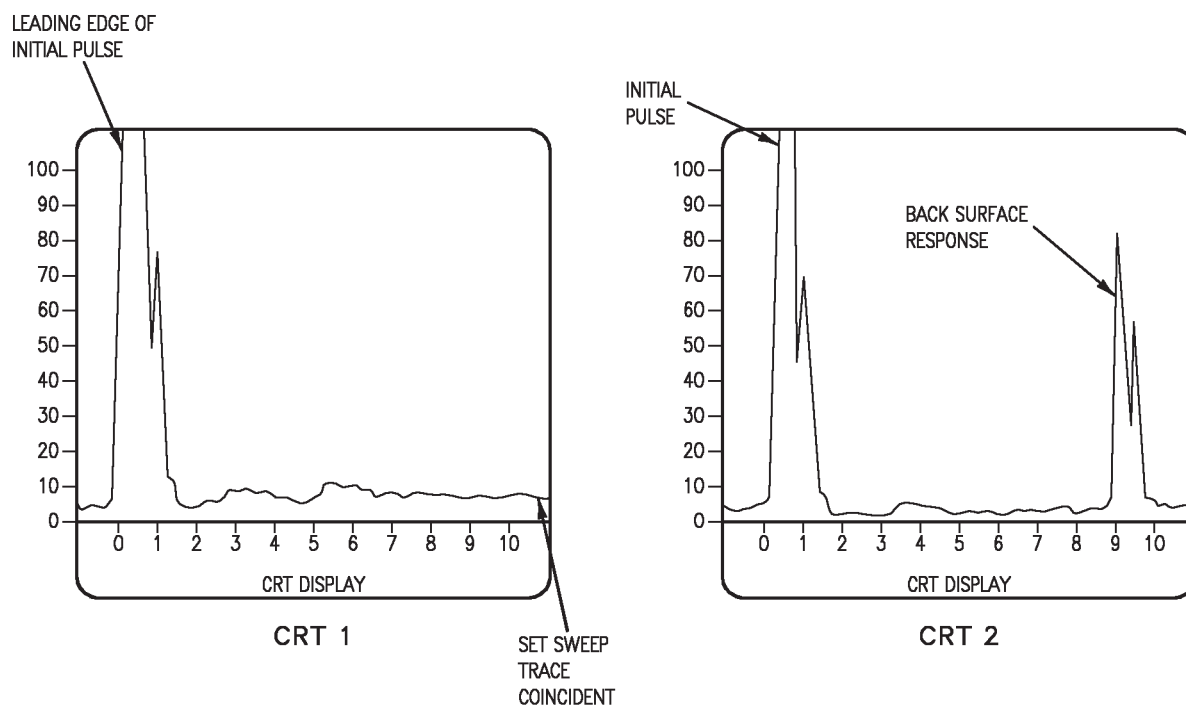
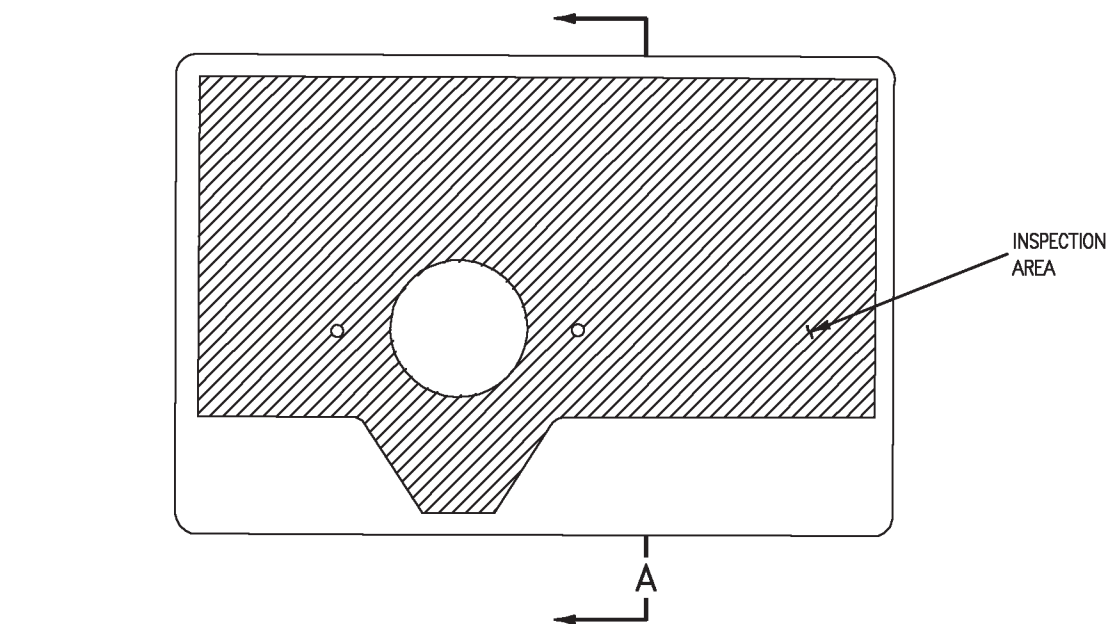


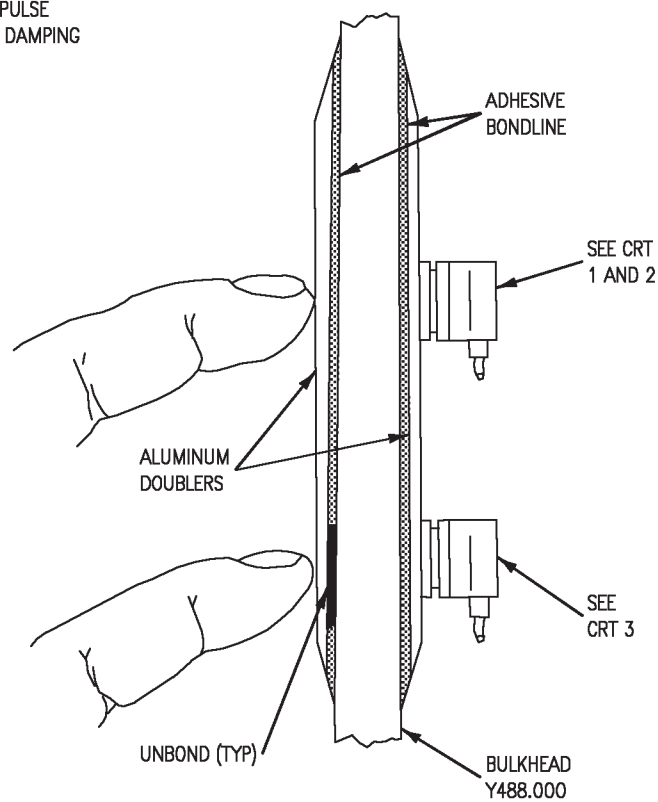
Figure 7. Fuel Pressure Line Hole Inspection



**Figure 8. Equipment Standardization for Bonded Doubler Using MXU-715/E Ultrasonic Flaw Detector**



## LEGEND



A

**Figure 9. Inspection Procedure for Bonded Aluminum Doublers on Bulkhead, Using MXU-715/E Ultrasonic Flaw Detector**

## INTERMEDIATE MAINTENANCE

## NONDESTRUCTIVE INSPECTION

## CENTER FUSELAGE BULKHEAD Y488.000, FUEL PRESSURE LINE HOLE AREA

## FATIGUE CRACKS

PART NO. 74A324206

EFFECTIVITY: 161720 AND UP

## Reference Material

Naval Aviation Maintenance Program .....	OPNAVINST 4790.2
Line Maintenance Access Doors .....	A1-F18AC-LMM-010
Piping Installation .....	A1-F18AC-PIM-000
Center Fuselage, Center Tunnel, Door 47 (Right Aft) .....	WP075 00
Secondary Power System .....	A1-F18AC-240-300
APU Accumulator and Start Valve Assembly (2L-P011) .....	WP007 00
Nondestructive Inspection .....	A1-F18AC-SRM-300
Eddy Current Hole Inspection of Aluminum Alloys .....	WP007 01

## Alphabetical Index

Subject	Page No.
Center Fuselage Bulkhead Y488.000, Fuel Pressure Line Hole Area .....	1
Defects .....	1
Primary Inspection Method .....	1
System Securing .....	3

## Record of Applicable Technical Directives

None

### 1. CENTER FUSELAGE BULKHEAD Y488.000, FUEL PRESSURE LINE HOLE AREA.

2. The center fuselage bulkhead Y488.000, fuel pressure line hole area (bulkhead) is machined from 7075 aluminum plate. The bulkhead is finished with an ion vapor deposition (IVD), aluminum, coating and epoxy primer.

3. **DEFECTS.** Inspect fuel pressure line hole and fastener holes for fatigue cracks, see figure 1.

4. **PRIMARY INSPECTION METHOD.** Primary inspection method is eddy current.

5. **Personnel Qualifications.** Personnel doing this nondestructive inspection should be qualified and certified to do eddy current inspections per OPNAVINST 4790.2 SERIES, NDI Technicians, NEC 7225/MOS 6044.

6. **Preparation of Aircraft.** No special preparation required.

## 7. Access.

- a. Have doors 42 and 47 removed (A1-F18AC-LMM-010).
- b. Have fuel pressure line removed (A1-F18AC-PIM-000, WP075 00).
- c. Have APU accumulator assembly removed (A1-F18AC-240-300, WP007 00).

## Support Equipment Required

## NOTE

Alternate item type designations or part numbers are listed in parentheses.

Part Number or  
Type Designation

## Nomenclature

ED520	Eddy Current Flaw Detector
64002-.190	Bolt Hole Probe
1HCF.2	Bolt Hole Probe, 0.200 Dia., Split Collar, Ferrite Shielded, GK Engineering
—	Teflon Eddy Current Probe Guide
Fabricate, Figure 2	
S20204	EDM Notch Reference Standard, Aluminum

## Materials Required

## NOTE

Alternate item specifications or part numbers are shown indented.

Specification  
or Part Number

## Nomenclature

P-D-680, TYPE 2 D 1153	Dry Cleaning Solvent Methyl Isobutyl Ketone
MIL-P-83953-2, TYPE 1, CLASS A or B, RED or BLACK	Aircraft Marking Pencil

## Materials Required (Continued)

## NOTE

Alternate item specifications or part numbers are shown indented.

Specification  
or Part Number

## Nomenclature

MIL-C-87962, TYPE 1	Cleaning Cloth
------------------------	----------------

## WARNING

Dry cleaning solvent and methyl isobutyl ketone, are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

8. **Preparation of Part.** Clean inspection area(s) with solvent moistened cloth to make sure inspection areas are free of contamination or foreign material.

9. **Equipment Settings/Standardization/Setup For Fastener Holes.** Do ED520 Flaw Detector Setup (WP007 01) except as below:

- a. Use 64002-.190 bolt hole probe (probe).
- b. Set FUNCTION to MED for sensitivity adjustment.
- c. Standardize, using applicable hole with 0.060 inch notch, on the aluminum EDM notched reference standard to get at least 150 microamperes needle deflection.

## 10. Inspection Procedure For Fastener Holes.

- a. Position probe in probe collar with center of coil set out approximately 0.010 inch from bottom edge of probe collar, see figure 3.
- b. Insert probe into fastener hole.
- c. Rotate probe to get maximum meter indication and set meter needle to 250 microamperes.



d. Rotate probe to inspect hole. Typical crack response will cause sharp needle movement down scale exceeding 100 microamperes.

e. Repeat steps a. thru d. with center of probe coil set out approximately 0.100 inch from bottom edge of probe collar.

f. Repeat steps a. thru d. with center of probe coil set out approximately 0.200 inch from bottom edge of probe collar.

g. Mark all suspect flaw indications with an aircraft marking pencil.

## 11. Equipment Settings/Standardization/Setup For Fuel Pressure Line Hole. Do ED520 Flaw Detector Setup (WP007 01) except as below:

a. Use 1HCF.2 ferrite shielded bolt hole probe.

b. Set FUNCTION to MED for sensitivity adjustment.

c. Standardize using the 1/4 inch hole with 0.060 inch notch in the aluminum, EDM notched reference standard to get at least 150 microamperes needle deflection.

d. Insert probe into probe guide, directing probe coil outward and approximately 0.110 inch from coil center to bottom seat edge, see figure 4.

e. Adjust two teflon tipped setscrews allowing only teflon tip of screws to protrude from probe guide, see figure 4.

## 12. Inspection Procedure For Fuel Pressure Line Hole.

a. Position probe guide in fuel pressure line hole, see figure 5.

b. Set meter needle to 250 microamperes.

c. Rotate probe to get maximum meter indication and reset meter needle to 250 microamperes.

d. Rotate probe to get maximum meter indication and reset meter needle to 250 microamperes.

e. Slowly rotate probe guide to inspect hole. Typical crack response will cause sharp needle deflection exceeding 100 microamperes.

f. Mark all suspect flow indications with aircraft marking pencil.

g. Readjust probe in probe guide, see figure 4, directing probe coil outward and approximately 0.200 inch from coil center to bottom seat edge. Repeat steps a. thru e. to inspect outer edge of hole.

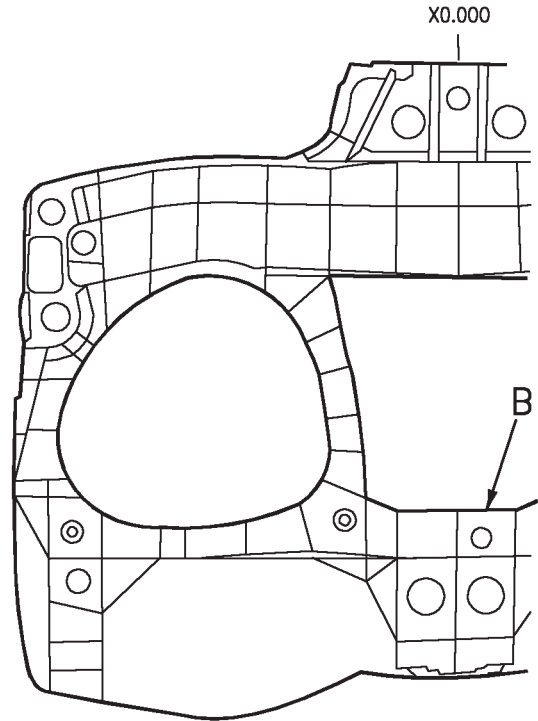
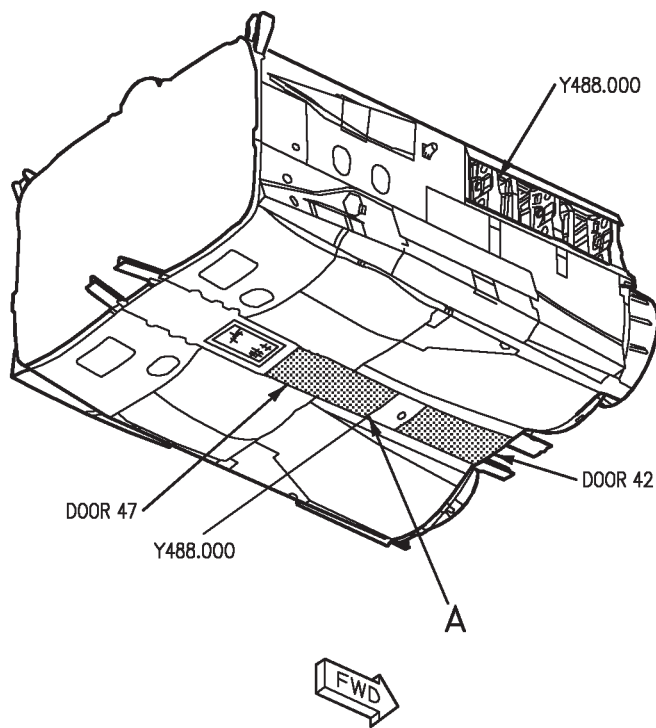
h. Readjust probe in probe guide approximately 0.010 inch from coil center to bottom seat edge. Repeat steps a. thru e. to inspect inner edge of hole.

## 13. SYSTEM SECURING.

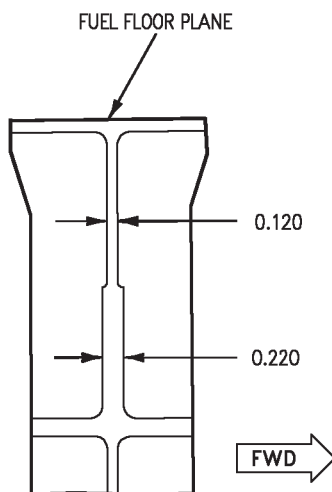
a. Have APU accumulator assembly reinstalled (A1-F18AC-240-300, WP007 00).

b. Have fuel pressure line reinstalled (A1-F18AC-PIM-000, WP075 00).

c. Have doors 42 and 47 reinstalled (A1-F18AC-LMM-010).



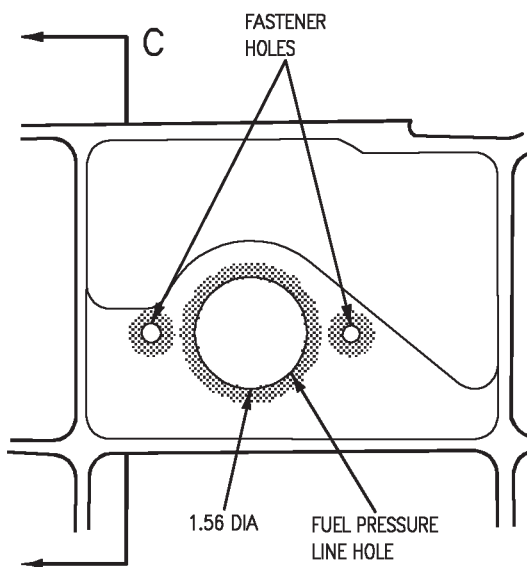
A  
Y488.000 BULKHEAD  
LOOKING FORWARD



C

## LEGEND

 INSPECTION AREAS



B  
LOOKING FORWARD

Figure 1. Location of Bulkhead Y488.000 and Inspection Areas

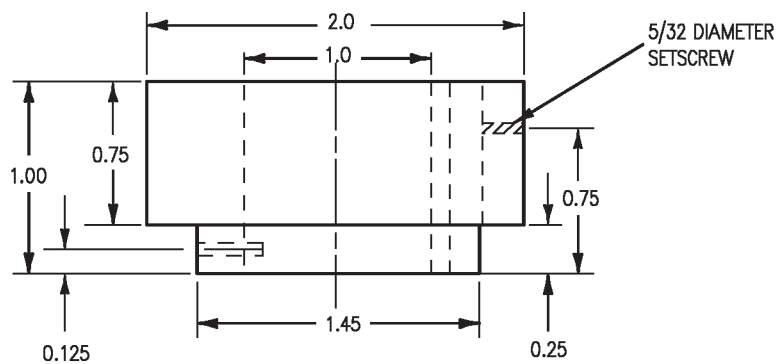
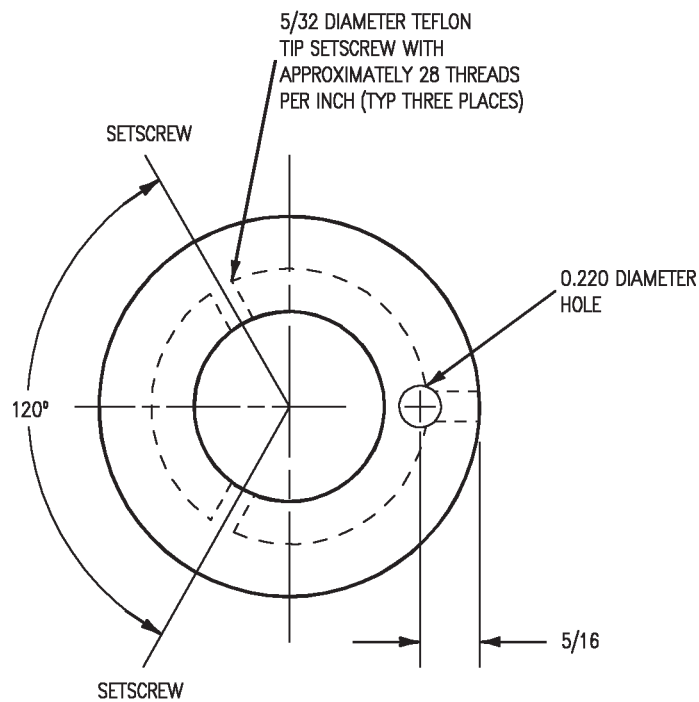


Figure 2. Teflon Eddy Current Probe Guide

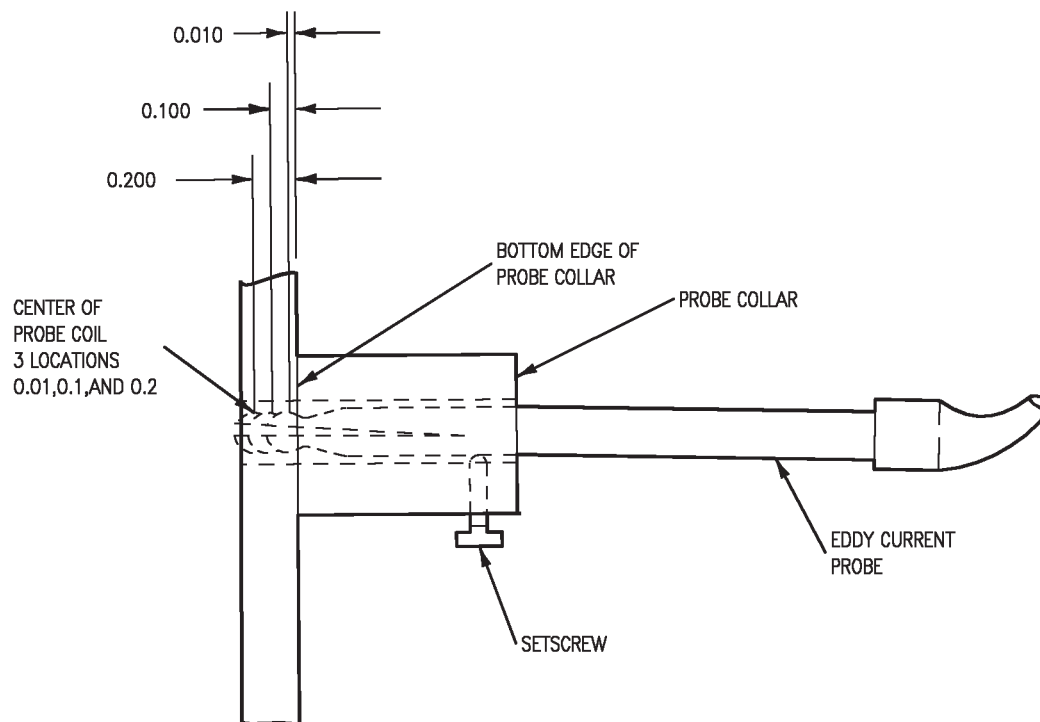
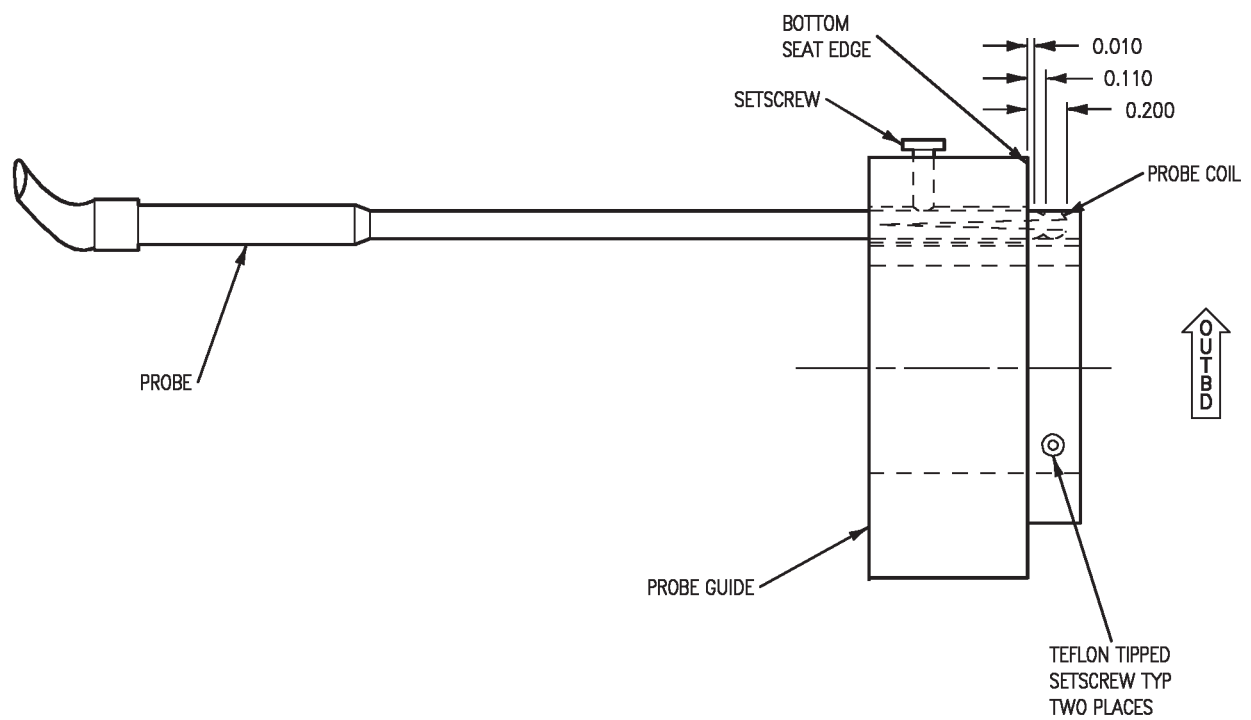


Figure 3. Probe Collar/Coil Position for Fastener Hole Inspection



### Figure 4. Probe/Probe Guide Adjustment, Setup

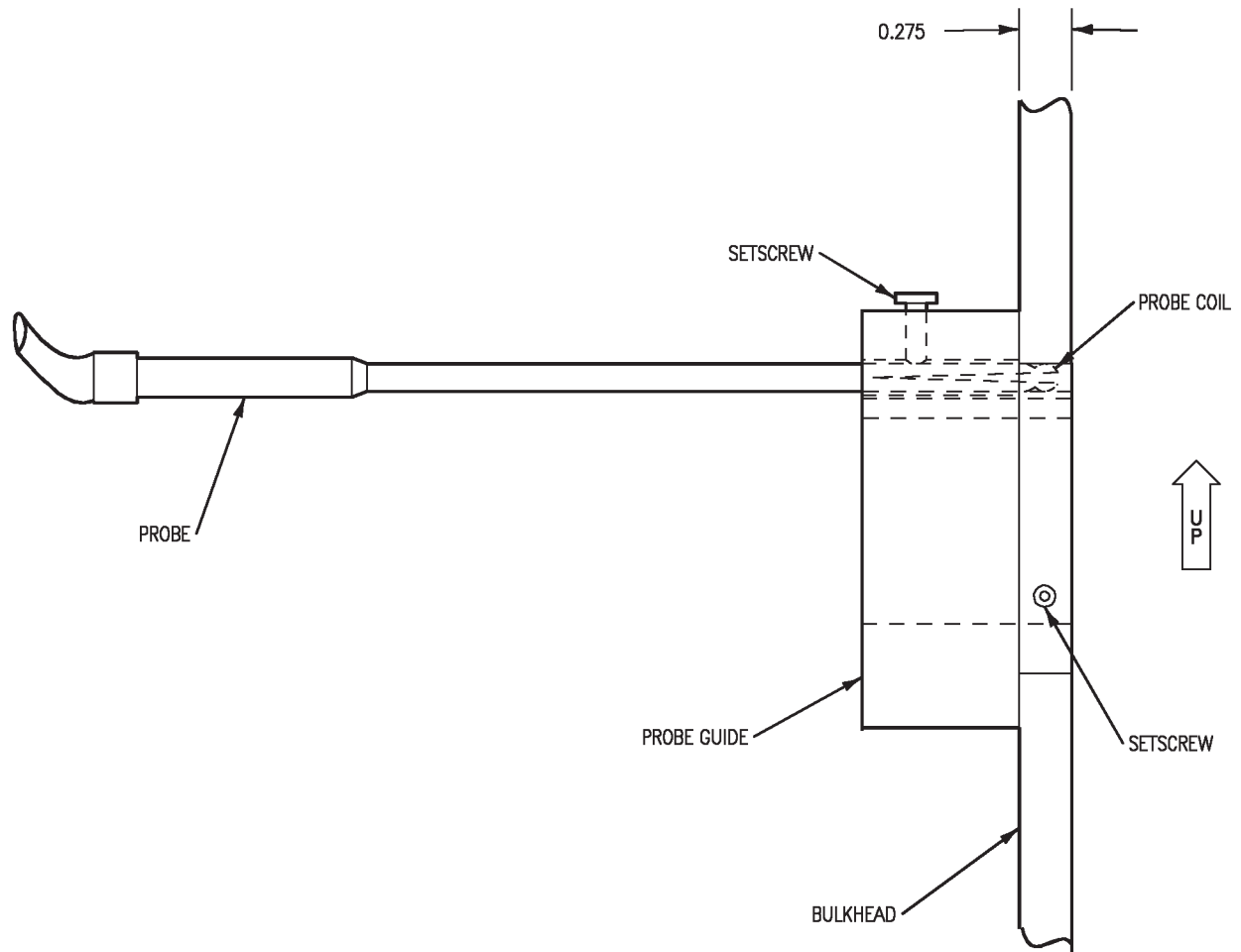


Figure 5. Fuel Pressure Line Hole Inspection

## INTERMEDIATE MAINTENANCE

## NONDESTRUCTIVE INSPECTION

## CENTER FUSELAGE BULKHEAD Y488.000, FLANGE AND FLANGE/WEB RADII

## FATIGUE CRACKS

PART NO. 74A324206

EFFECTIVITY: 161719 AND UP

## Reference Material

Naval Aviation Maintenance Program .....	OPNAVINST 4790.2
Structure Repair, General Information .....	A1-F18AC-SRM-200
Fasteners .....	WP004 06
Nondestructive Inspection.....	A1-F18AC-SRM-300
Eddy Current Surface Inspection of Aluminum Alloys .....	WP007 00
Eddy Current Hole Inspection of Aluminum Alloys .....	WP007 01
Penetrant Method.....	WP004 00
Aircraft Corrosion Control.....	A1-F18AC-SRM-500
Stripping.....	WP007 00
Finish System .....	WP012 00

## Alphabetical Index

Subject	Page No.
Center Fuselage Bulkhead Y488.000, Flange and Flange/Web Radii .....	1
Backup Inspection Method .....	3
Defects .....	1
Post Inspection Cleaning and Corrosion Control.....	4
Primary Inspection Method .....	1
System Securing.....	4

## Record of Applicable Technical Directives

None

**1. CENTER FUSELAGE BULKHEAD  
Y488.000, FLANGE AND FLANGE/WEB  
RADII.**

2. The center fuselage bulkhead Y488.000, flange and flange/web radii are machined from 7075 aluminum plate. Surface finish is ion vapor

deposition (IVD), aluminum, and epoxy primer coating.

**3. DEFECTS.** Inspect flange, fastener holes, and flange/web radii for fatigue cracks, see figure 1.

**4. PRIMARY INSPECTION METHOD.** Primary inspection method is eddy current.

5. **Personnel Qualifications.** Personnel doing this nondestructive inspection should be qualified and certified to to eddy current inspections per OPNAVINST 4790.2 SERIES, NDI Technicians, NEC 7225/MOS 6044.

6. **Preparation of Aircraft.** No special preparation required.

7. **Access.** No special access required.

### Support Equipment Required

#### NOTE

Alternate item type designations or part numbers are listed in parentheses.

Part Number or Type Designation	Nomenclature
ED520	Eddy Current Flaw Detector
64101	Bolt Hole Probe, 0.250 Dia., Ideal Speciality
S20204	EDM Notch Reference Standard, Aluminum
1RR40F-6-1/2	45° Angle Surface Probe

### Materials Required

#### NOTE

Alternate item specifications or part numbers are shown indented.

Specification or Part Number	Nomenclature
P-D-680, TYPE 2 D 1153	Dry Cleaning Solvent Methyl Isobutyl Ke- tone
MIL-P-83953-2, TYPE 1, CLASS A or B, RED or BLACK	Aircraft Marking Pencil
MIL-C-87962, TYPE 1	Cleaning Cloth
CCC-C-440, TYPE 1, CLASS 1	Cheesecloth

### 8. Preparation of Part.

a. Have six fasteners removed, see figure 1 for location. For removal (A1-F18AC-SRM-200, WP004 06).

#### WARNING

Dry cleaning solvent and methyl isobutyl ketone, are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

b. Clean inspection areas with solvent moistened cloth to make sure inspection areas are free of contamination or foreign material.

9. **Equipment Setting/Standardization/Setup For Fastener Holes.** Do ED520 Flaw Detector Setup (WP007 01) except as below:

a. Use 0.250 diameter bolt hole probe (probe).

b. Use EDM notched reference standard to get approximately 150 microamperes needle deflection by passing probe across 0.060 inch EDM notch in hole of reference standard.

10. **Inspection Procedure For Fastener Holes.** Do Inspection Procedure (WP007 01) except as below:

a. Position probe in hole.

b. Adjust probe collar as required.

c. Adjust meter needle to 250 microamperes using BALANCE.

d. Scan inspection holes by rotating probe at constant rate, no more than rate required to get EDM response on reference standard.



**NOTE**

Sharp needle movements down scale are characteristic of crack indications. Up scale deflections may not be significant. Probe near edge of hole will cause needle balance point to move down scale. Reset balance point to 250 microamperes with BALANCE after each interval.

e. Mark all areas with an aircraft marking pencil where sharp down scale deflection of meter needle indicates crack.

**11. Equipment Settings/Standardization/Setup For Flange and Flange/Web Radii.** Do ED520 Flaw Detector Setup (WP007 00) except as below:

a. Use 45° angle surface probe (probe).

b. Use aluminum eddy current reference standard to get approximately 300 microamperes needle deflection by passing probe across 0.040 inch by 0.020 inch deep EDM notch of reference standard.

**12. Inspection Procedure For Flange and Flange/Web Radii.** Do Inspection Procedure (WP007 00) except as below:

a. Position probe on flat, smooth surface of inspection area.

b. Use BALANCE to set meter needle at 250 microamperes.

**NOTE**

When probe is moved near edge of part, fastener hole, or radii, meter needle may gradually move down scale. If required, use BALANCE to return meter needle to 250 microamperes and scan parallel to edge of radii.

c. Scan inspection areas in directions shown in figure 1. Scan at constant rate, no faster than rate used to standardize equipment. After each scan, index probe 1/16-inch, 90° to scan direction, and repeat until complete area has been inspected.

d. Mark all areas with aircraft marking pencil where sharp down scale deflection of meter needle indicates crack.

**13. BACKUP INSPECTION METHOD.** Backup inspection method is fluorescent penetrant. Fluorescent penetrant inspection may be used to verify surface indications detected by primary inspection method. See figure 1.

**14. Personnel Qualifications.** Personnel doing this nondestructive inspection should be qualified and certified to do liquid penetrant inspections per OPNAVINST 4790.2 SERIES, NDI Technicians, NEC 7225/MOS 6044.

**15. Preparation of Aircraft.** No special preparation required.

**16. Access.** No special access required.

**Support Equipment Required****NOTE**

Alternate item type designations or part numbers are listed in parentheses.

Part Number or Type Designation	Nomenclature
ZA43 (TT10) (XMA101)	Portable Fluorescent Penetrant Inspection Kit
—	14 X Magnifier
M-16	Black Light

**Materials Required****NOTE**

Alternate item specifications or part numbers are shown indented.

Specification or Part Number	Nomenclature
P-D-680, TYPE 2 D 1153	Dry Cleaning Solvent Methyl Isobutyl Ketone
A-A-883, TYPE 1	Pressure Sensitive Tape, Masking Tape
MIL-P-83953-2, TYPE 1, CLASS A or B, RED or BLACK	Aircraft Marking Pencil
CCC-C-440, TYPE 1, CLASS 1	Cheesecloth

## 17. Preparation of Part.



Make sure inspection areas are not mechanically worked with abrasive paper or files before initial penetrant inspection to avoid smearing metal.

- a. Have finish system removed from inspection areas shown in figure 1 (A1-F18AC-SRM-500, WP007 00).



Dry cleaning solvent and methyl isobutyl ketone are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

- b. Clean inspection areas with solvent moistened cloth to be sure inspection areas are free of contamination or foreign material.

## 18. Inspection Procedure.

- a. Do type 1, method C fluorescent penetrant inspection (WP004 00) to detect fatigue cracks in areas shown in figure 1.
- b. Remove excess penetrant by hand wiping as below:

- (1) After penetrant dwell time is complete, remove excess penetrant with dry cheesecloth.

### NOTE

Remove fluorescent penetrant in shaded or darkened area. View area with aid of black light.

- (2) To remove background color or fluorescence, wipe inspection areas with cloth moistened with fluorescent penetrant remover.

- c. Spray thin film of developer on inspection areas.

- d. Use black light and magnifier, if required, to view inspection areas for cracks.

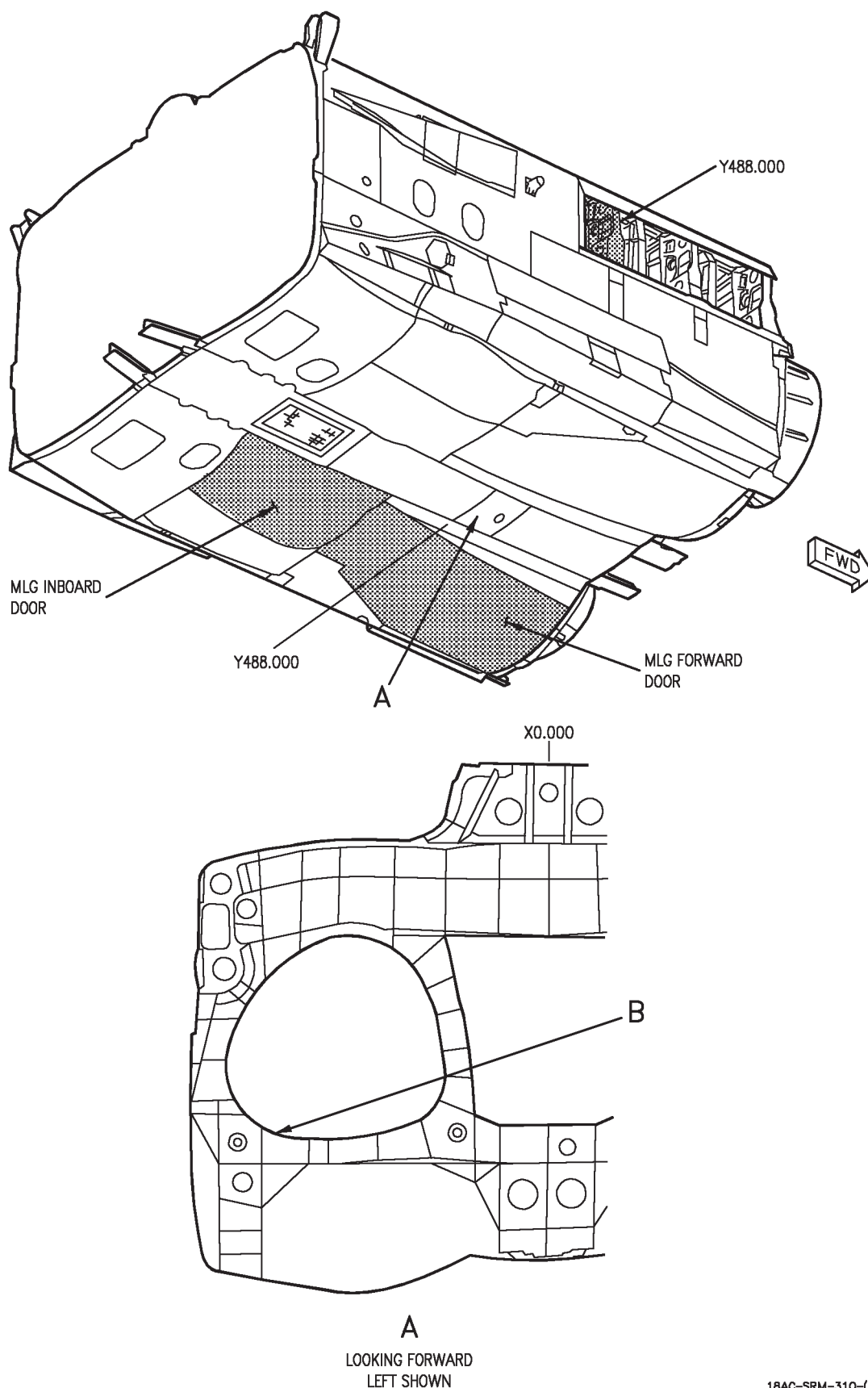
- e. Evaluate indications, mark location of any defect with an aircraft marking pencil.

## 19. POST INSPECTION CLEANING AND CORROSION CONTROL.

- a. Clean inspection material from part with cloth moistened with fluorescent penetrant remover.

- b. Refinish inspection area (A1-F18AC-SRM-500, WP012 00).

- ## 20. SYSTEM SECURING.
- Have fasteners reinstalled (A1-F18AC-SRM-200, WP004 06).



**Figure 1. Location of Bulkhead Y488.000 and Inspection Areas (Sheet 1)**

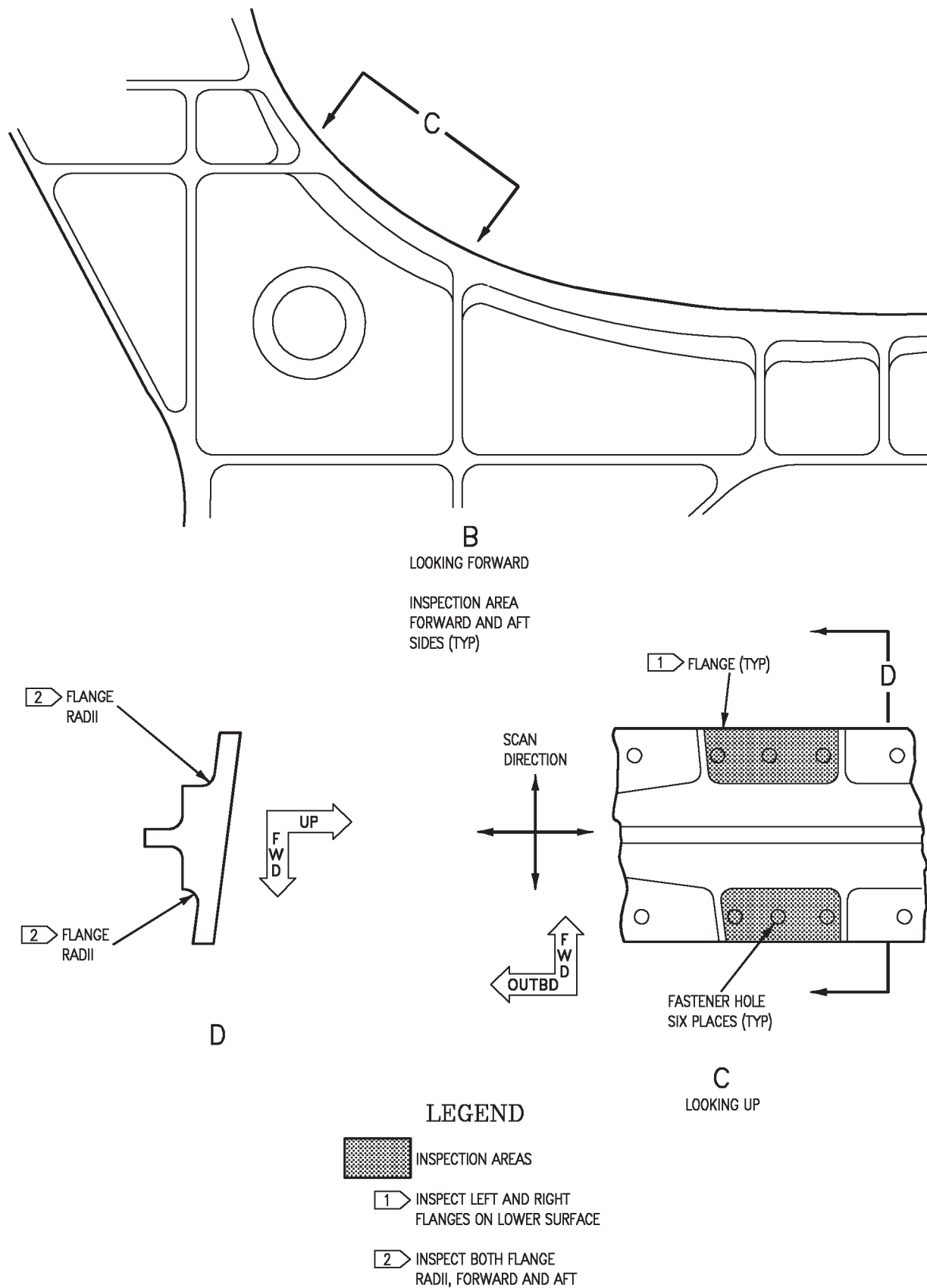


Figure 1. Location of Bulkhead Y488.000 and Inspection Areas (Sheet 2)

## DEPOT MAINTENANCE

## NONDESTRUCTIVE INSPECTION

## CENTER FUSELAGE BULKHEAD Y488.000, HYDRAULIC LINE HOLE AREA

## FATIGUE CRACKS AND UNBONDS

PART NO. 74A324206

EFFECTIVITY: 161705 THRU 161718

## Reference Material

Plane Captain Manual .....	A1-F18AC-PCM-000
Naval Aviation Maintenance Program .....	OPNAVINST 4790.2
Piping Installation .....	A1-F18AC-PIM-000
Right Main Landing Gear Wheelwell .....	WP085 00
Nondestructive Inspection.....	A1-F18AC-SRM-300
Eddy Current Hole Inspection of Aluminum Alloys.....	WP007 01

## Alphabetical Index

Subject	Page No.
Center Fuselage Bulkhead Y488.000, Hydraulic Line Hole Area .....	1
Defects .....	2
Eddy Current Method Using ED520 Eddy Current Flaw Detector.....	4
Eddy Current Method Using MXU-713/E Eddy Current Flaw Detector .....	3
Post Inspection Cleaning and Corrosion Control.....	8
Primary Inspection Methods.....	2
System Securing.....	8
Ultrasonic Method Using C-398 Ultrasonic Flaw Detector .....	2
Ultrasonic Method Using MXU-715/E Ultrasonic Flaw Detector .....	5

## Record of Applicable Technical Directives

None

1. CENTER FUSELAGE BULKHEAD  
Y488.000, HYDRAULIC LINE HOLE AREA.

2. Center fuselage bulkhead Y488.000, hydraulic line hole area (hydraulic line hole area) is machined from 7075 aluminum plate. Bulkhead is

finished with ion vapor deposition (IVD) aluminum, coating. Surface finish is epoxy primer and polyurethane finish system. Aluminum plates (doublers) are bonded to bulkhead with EA9321 adhesive. Surface finish is conversion coating and epoxy primer.

3. **DEFECTS.** Inspect hydraulic line hole for fatigue cracks and doublers bonded to web for adhesive unbonds, see figure 1.
4. **PRIMARY INSPECTION METHODS.** Primary inspection methods are pulse echo, contact ultrasonic, and eddy current.
5. **Personnel Qualifications.** Personnel doing this nondestructive inspection should be qualified and certified to do Ultrasonic and eddy current inspections per OPNAVINST 4790.2 SERIES, NDI Technicians, NEC 7225/MOS 6044.
6. **Preparation of Aircraft.** No special preparation required.
7. **Access.** Remove hydraulic lines (A1-F18AC-PIM-000, WP085 00).
8. **ULTRASONIC METHOD USING C-398 ULTRASONIC FLAW DETECTOR.**

Support Equipment Required

NOTE

Alternate item type designations or part numbers are listed in parentheses.

Part Number or Type Designation	Nomenclature
C-398 (303B)	Ultrasonic Flaw Detector
57A2271 or EQUIVALENT	Microdot to BNC Connecting Cable
57A2275	0°, 0.375 Dia., 2.25 MHz, Contact Search Unit
57A4244-30	IIW-2 Aluminum Test Block

Materials Required

NOTE

Alternate item specifications or part numbers are shown indented.

Specification or Part Number	Nomenclature
P-D-680, TYPE 2, D 1153	Dry Cleaning Solvent Methyl Isobutyl Ketone
ULTRAGEL II MIL-P-83953-2, TYPE 1, CLASS A or B, RED or BLACK	Couplant Aircraft Marking Pencil
CCC-C-46, TYPE 1, CLASS 4	Cleaning Cloth

9. Preparation of Part

- a. Locate inspection area and visually inspect applicable surfaces. Areas cracked may show accumulation of dirt and soot.
- b. Inspect inside of hole to make sure surface is smooth without abrupt discontinuities such as chipped paint or primer.

WARNING

- Dry cleaning solvent and methyl isobutyl ketone are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition. .
- c. Clean inspection area with solvent moistened cloth to make sure inspection area is free of contamination or foreign material.

10. Equipment Settings/Standardization/Setup For Bonded Aluminum Doublers On Y488.000 Bulkhead. See figure 2.

- a. Connect 57A2275 search unit to Microdot connecting cable.

b. Plug BNC end of microdot connecting cable into ultrasonic flaw detector (tester) T or R BNC jack.

c. Turn tester ON. Allow 15 minutes warm-up.

d. Set tester front face settings:

#### NOTE

Equipment difference may require use of alternate COARSE SWEEP RANGE, FREQ, FINE SWEEP RANGE, DAMPING, and REJECT settings.

COARSE SWEEP RANGE.....	0.5 INCH
ATTENUATORS:	
OUT.....	2, 16, and 32
IN.....	4 and 8
FILTER.....	OFF
COARSE SWEEP DELAY.....	0 - 3 INCHES
FREQ.....	2.25 MHz
MODE.....	PULSE-ECHO
FINE GAIN.....	MAX
REP RATE.....	AUTO
FINE SWEEP RANGE.....	MIN
DAMPING.....	APPROX. MID SCALE
REJECT.....	APPROX. 0
VIDEO EITHER +,	
DISPLAY.....	-, or FULL WAVE

e. With search unit held in the air or face up on work surface, adjust FINE SWEEP DELAY until initial pulse is located at zero on CRT horizontal baseline. See figure 2, CRT 1.

#### NOTE

Initial and echo pulses shown in figure 2 may differ from actual wave shape.

f. Adjust VERT POS, if required, to set sweep trace coincident with CRT horizontal baseline.

g. Apply couplant to 0.75 inch thick area of test block see figure 2. Position search unit on surface of 0.75 inch thick area of test block, see figure 2.

h. Position search unit on surface of 0.75 inch thick area of test block, see figure 2.

i. Adjust FINE SWEEP RANGE and COARSE SWEEP RANGE if required, so back response is located at 9 on horizontal baseline, and peak amplitude of 80 to 90 percent of CRT height. See figure 2, CRT 2.

#### 11. Inspection Procedure For Bonded Aluminum Doublers on Bulkhead. See figure 3.

#### NOTE

GAIN may be adjusted by changing FINE GAIN, COARSE GAIN, or by toggling ATTENUATORS.

a. Add 12dB GAIN.

#### NOTE

It may be required to add more than 12dB of gain for thick or porous bondlines.

b. Apply light film of couplant to one doubler, and position search unit on doubler. See figure 8, detail A.

c. Inspect adhesive bond between doublers and bulkhead per substeps below:

(1) Position search unit on doubler having light film of couplant and observe CRT display. See figure 3, CRT 1, for example.

(2) Finger damp to make sure correct back surface response is received. Apply couplant to finger, cotton swab, or pencil eraser, and touch doubler on side opposite search unit, as shown in figure 3, detail A. Amplitude of back surface response will change as doubler is touched on side opposite search unit and finger damped, see figure 3, CRT 2. Amplitude of back surface response will not change when finger damped if unbond exists, see figure 3, CRT 3.

d. Mark all unbonds with aircraft marking pencil and record all areas that indicate adhesive unbonds.

e. Do paragraphs 24. and 25.



## 12. EDDY CURRENT METHOD USING ED520 EDDY CURRENT FLAW DETECTOR.

### Support Equipment Required

Part Number or Type Designation	Nomenclature
ED520	Eddy Current Flaw Detector, MagnaTest
S20204	EDM Notch Reference Standard, Aluminum
—	Teflon Eddy Current Probe Guide
Fabricate Per Figure 4	

### Materials Required

#### NOTE

Alternate item specifications or part numbers are shown indented.

Specification or Part Number	Nomenclature
P-D-680, TYPE 2 D 1153	Dry Cleaning Solvent Methyl Isobutyl Ke- tone
MIL-P-83953-2, TYPE 1, CLASS A or B, RED or BLACK	Aircraft Marking Pencil
MIL-C-87962, TYPE 1	Cleaning Cloth

#### WARNING

Dry cleaning solvent and methyl isobutyl ketone are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

13. **Preparation of Part.** Clean inspection area with solvent moistened cloth to make sure inspection area is free of contamination or foreign material.

#### WARNING

Make sure safety precautions are met for electrical, static, grounding when using Ultrasonic equipment near aircraft fuel cells, oxygen systems, electrical systems, electronic systems, and stores (A1-F18AC-PCM-000).

14. **Equipment Settings/Standardization/Setup For Hydraulic Line Hole.** See figure 1. Do ED520 Flaw Detector Setup (WP007 01) except as below:

- Use 3/16 inch diameter ferrite shielded bolt hole probe.
- Set FUNC MODE to MED for sensitivity adjustment.
- Standardize using approximate size hole with 0.060 inch notch in aluminum EDM notched reference standard to get at least 150 microamperes needle deflection.
- Insert eddy current probe (probe) into probe guide (guide) directing probe coil outward and approximately 0.18 inch from coil center to bottom seat edge, see figure 5.
- Adjust 2 teflon tipped setscrews allowing only teflon tip of screws to protrude from guide, see figure 5.

15. **Inspection Procedure For Hydraulic Line Hole.**

- Position probe and guide in hydraulic line hole, see figure 6.
- Set meter needle to 250 microamperes.
- Rotate probe until maximum meter reading is received and set meter needle to 250 microamperes.
- Slowly rotate guide to inspect hole. Typical crack response will cause sharp needle deflection down scale exceeding 100 microamperes.
- Mark all suspect flaw indications with aircraft marking pencil.
- Record all defects.
- Do paragraphs 24 and 25.



## 16. ULTRASONIC METHOD USING MXU-715/E ULTRASONIC FLAW DETECTOR.

### Support Equipment Required

Part Number or Type Designation	Nomenclature
1642AS100-1	Ultrasonic Flaw Detector, MXU-715/E, Magnaflux
57A2271 or EQUIVALENT 57A2275	Microdot to BNC Connecting Cable 0°, 0.375 Dia., 2.25 MHz, Contact Search Unit
57A4244-30	IIW-2 Aluminum Test Block

### Materials Required

#### NOTE

Alternate item specifications or part numbers are shown indented.

Specification or Part Number	Nomenclature
P-D-680, TYPE 2, D 1153	Dry Cleaning Solvent Methyl Isobutyl Ke- tone
ULTRAGEL II MIL-P-83953-2, TYPE 1, CLASS A or B, RED or BLACK	Couplant Aircraft Marking Pencil
CCC-C-46, TYPE 1, CLASS 4	Cleaning Cloth

## 17. Preparation of Part.

a. Locate inspection area and visually inspect applicable surfaces. Areas cracked may show accumulation of dirt and soot.

b. Inspect inside of hole to make sure surface is smooth without abrupt discontinuities such as chipped paint or primer.

### WARNING

Dry cleaning solvent and methyl isobutyl ketone are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

c. Clean inspection area(s) with solvent moistened cloth to make sure inspection area(s) is free of contamination or foreign material.

### WARNING

Make sure safety precautions are met for electrical, static, grounding when using Ultrasonic equipment near aircraft fuel cells, oxygen systems, electrical systems, electronic systems, and stores (A1-F18AC-PCM-000).

## 18. Equipment Settings/Standardization/Setup For Bonded Aluminum Doublers On Y488.000 Bulkhead. See figure 7.

a. Connect 57A2275 search unit to Microdot connecting cable.

b. Plug BNC end of microdot connecting cable into ultrasonic flaw detector (tester) T or R BNC jack.

c. Turn tester ON. Allow 5 minutes warm-up.

d. Set tester front face settings:

#### NOTE

Tester settings listed here are given as initial setup guide. Equipment differences may require use of alternate REP. RATE, DAMP., FREQ., GAIN, REJECT, and HORIZONTAL SWEEP DELAY and LENGTH.

REP. RATE.....	AUTO
VOLT .....	FULL
DAMP .....	MIN.

FREQ..... 2.25 MHz  
 MODE ..... ECHO  
 GAIN (dB)..... (49dB)  
     COURSE GAIN ..... 4  
     FINE GAIN ..... 9  
 VIDEO  
     FILTER..... 3  
     MODE ..... F.W.  
 REJECT..... 0  
 SYNC..... REP. REP.  
 HORIZONTAL  
     SWEEP DELAY  
         COURSE..... 5 INCH  
         FINE..... 9 INCH  
 HORIZONTAL  
     SWEEP LENGTH  
         COURSE..... 1 INCH  
         FINE..... 7 INCH  
 POLARITY..... OFF  
 DISTANCE ECHO  
     CORRECTION..... OFF

e. With search unit held in the air or face up on work surface, adjust HORIZONTAL SWEEP FINE DELAY until initial pulse is located at zero on CRT horizontal baseline. See figure 7, CRT 1.

#### NOTE

Initial and echo pulses shown in figure 7 may differ from actual wave shape.

f. Adjust VERT POS, if required, to set sweep trace coincident with CRT horizontal baseline.

g. Apply couplant to 0.75 inch thick area of test block see figure 7. Position search unit on surface of 0.75 inch thick area of test block , see figure 7.

h. Position search unit on surface of 0.75 inch thick area of test block, see figure 7.

i. Adjust HORIZONTAL SWEEP FINE LENGTH, and COARSE LENGTH, if required, so back response is located at 9 on horizontal baseline, and peak amplitude of 80 to 90 percent of CRT height. See figure 7, CRT 2.

#### 19. Inspection Procedure For Bonded Aluminum Doublers on Bulkhead. See figure 8.

a. Add 12dB GAIN.

#### NOTE

It may be required to add more than 12dB of gain for thick or porous bondlines.

b. Apply light film of couplant to one doubler, and position search unit on doubler. See figure 8, detail A.

c. Inspect adhesive bond between doublers and bulkhead per substeps below:

(1) Position search unit on doubler having light film of couplant and observe CRT display. See figure 3, CRT 1, for example.

(2) Make sure correct back surface response is received by finger damping. Apply couplant to finger, cotton swab, or pencil eraser, and touch doubler on side opposite search unit, as shown in figure 3, detail A. Amplitude of back surface response will change as doubler is touched on side opposite search unit and finger damped, see figure 3, CRT 2. Amplitude of back surface response will not change when finger damped if unbond exists, see figure 3, CRT 3.

d. Mark all unbonds with aircraft marking pencil and record all areas that indicate adhesive unbonds.

#### 20. EDDY CURRENT METHOD USING MXU-713/E EDDY CURRENT FLAW DETECTOR.

#### Support Equipment Required

##### Part Number or Type Designation

##### Nomenclature

NDT 25N  
 MXU-713/E  
 9505955

Programmable  
 Eddyscope, Nortec  
 NDT 25N Accessory  
 Kit, Nortec

### Support Equipment Required (Continued)

Part Number or Type Designation	Nomenclature
1-HC-3/16 or EQUIVALENT	Absolute Bolt Hole Probe 3/16 Dia., 500 kHz, Ferrite Shielded (2 Req'd)
— Fabricate Per Figure 4	Teflon Eddy Current Probe Guide
SH-7050-17 or EQUIVALENT 57A2271	Aluminum Notched Reference Standard Microdot to BNC Connecting Cable (2 Req'd)

### Materials Required

#### NOTE

Alternate item specifications or part numbers are shown indented.

Specification or Part Number	Nomenclature
P-D-680, TYPE 2, D 1153	Dry Cleaning Solvent Methyl Isobutyl Ketone
ULTRAGEL II MIL-P-83953-2, TYPE 1, CLASS A or B, RED or BLACK	Couplant Aircraft Marking Pencil
ULTRAGEL II CCC-C-46, TYPE 1, CLASS 4	Couplant Cleaning Cloth

#### 21. Preparation of Part.

- Locate inspection area and visually inspect applicable surfaces. Areas that are cracked may show accumulation of dirt and soot.
- Inspect inside of hole to make sure surface is smooth without abrupt discontinuities such as

chipped paint or primer.

#### WARNING

Dry cleaning solvent and methyl isobutyl ketone are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

- Clean inspection area(s) with solvent moistened cloth to make sure inspection area(s) is free of contamination or foreign material.

#### WARNING

Make sure safety precautions are met for electrical, static, grounding when using Ultrasonic equipment near aircraft fuel cells, oxygen systems, electrical systems, electronic systems, and stores (A1-F18AC-PCM-000).

#### 22. Equipment Settings/Standardization/Setup For Hydraulic Line Hole. Do MXU-713/E Flaw Detector (tester) Setup (WP007 01) except as below:

- Use standardization of absolute probes.
- Use two 1-HC-3/16 probes.
- Use SH-7075-17 reference standard.
- Use frequency of 200 kHz.

#### 23. Inspection Procedure For Hydraulic Line Hole. Do inspection of hydraulic line hole (WP007 01) except as below:

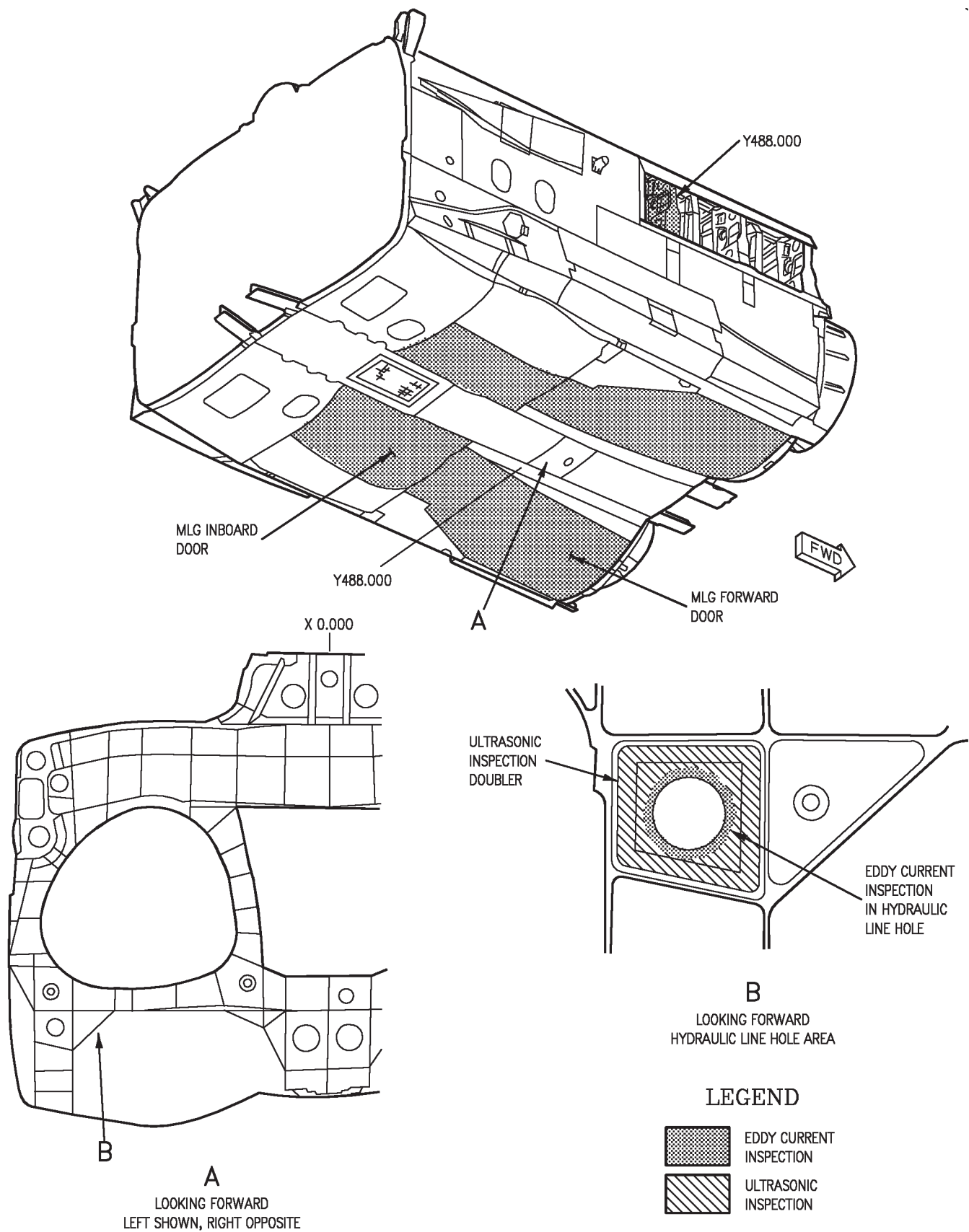
- Insert probe into probe guide directing probe coil outward and approximately 0.18 inch from coil center to bottom seat edge, see figure 5.
- Adjust two teflon tipped setscrews allowing only teflon tip of screw to protrude from probe guide, see figure 5.

## WARNING

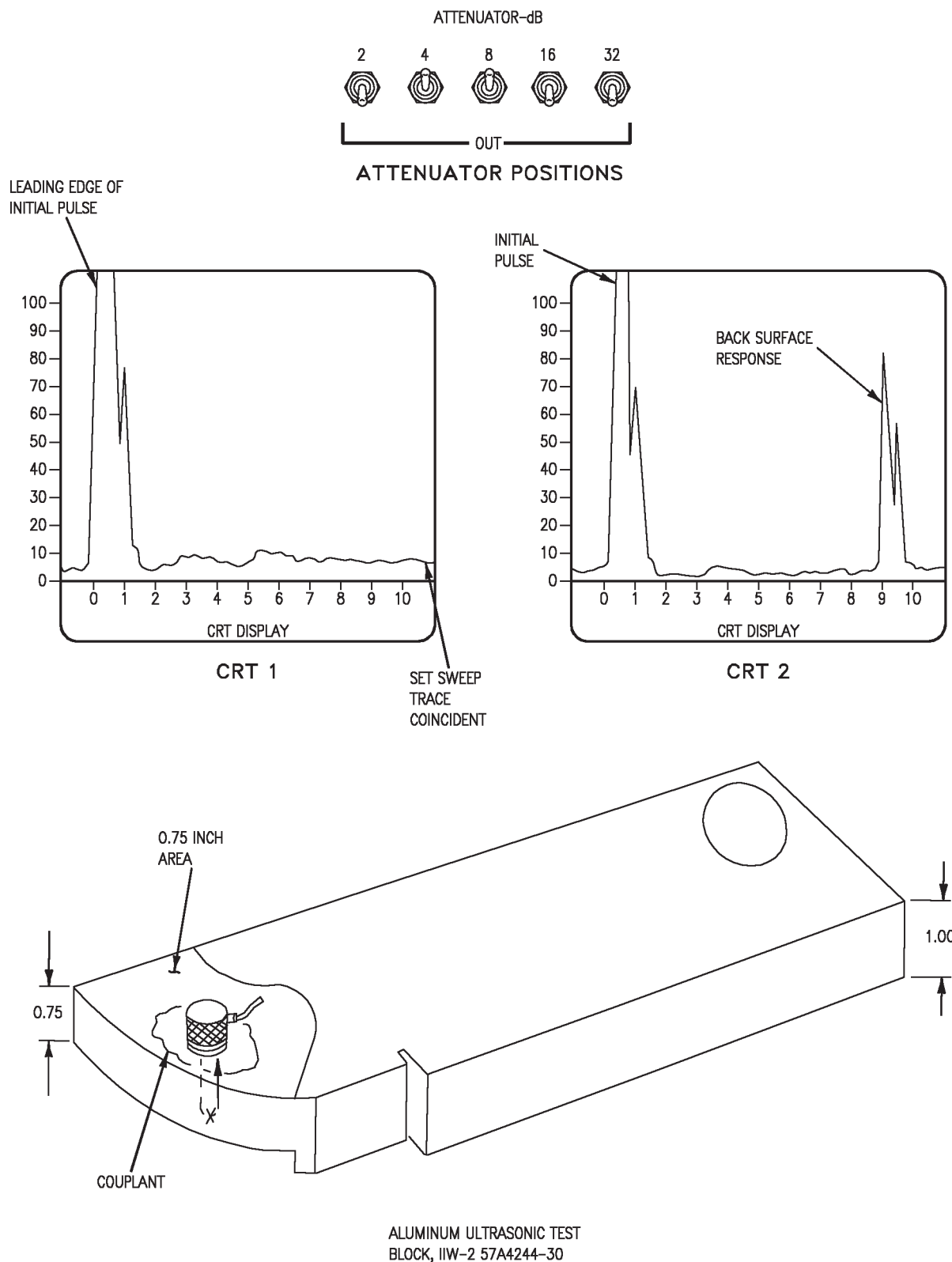
Dry cleaning solvent and methyl isobutyl ketone are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

**24. POST INSPECTION CLEANING AND CORROSION CONTROL.** Clean inspection area with solvent moistened cloth to make sure inspection area is free of contamination or foreign material.

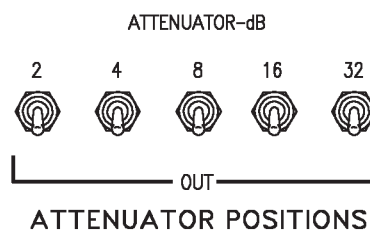
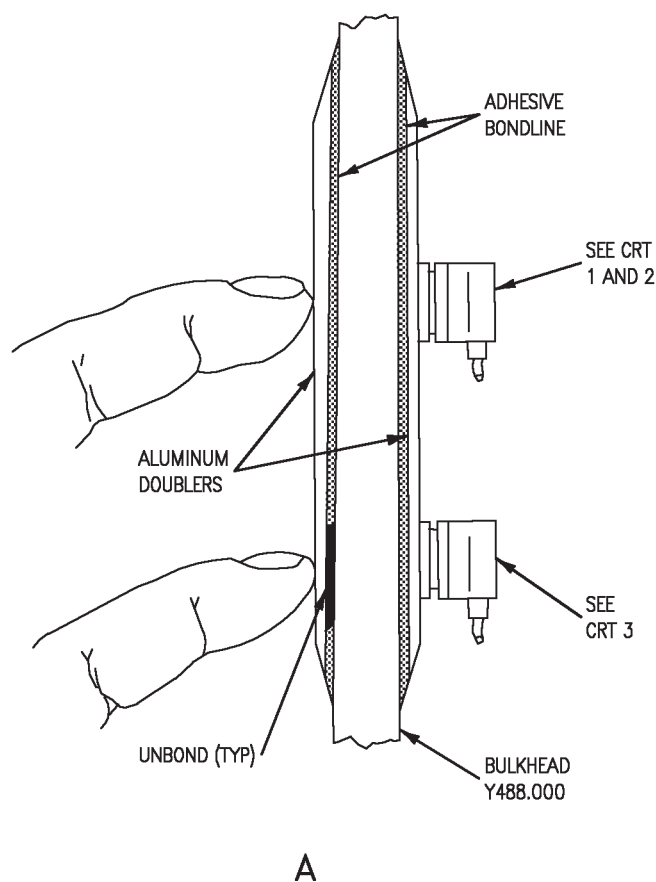
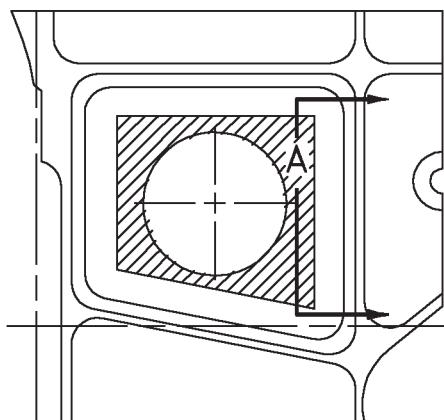
**25. SYSTEM SECURING.** Reinstall hydraulic lines (A1-F18AC-PIM-000, WP085 00).



**Figure 1. Center Fuselage Bulkhead Y488.000, Hydraulic Line Hole Inspection Area**



**Figure 2. Equipment Standardization Using C-398 Ultrasonic Flaw Detector**

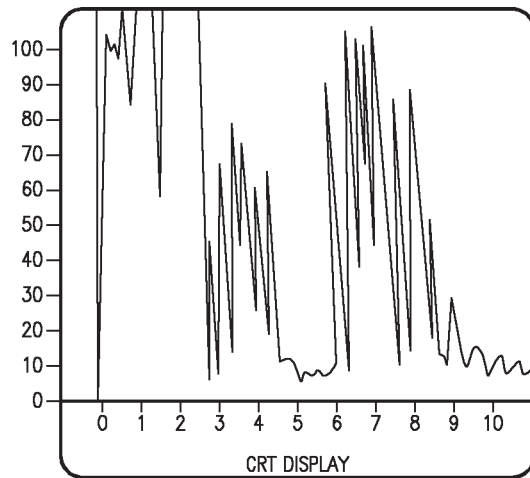


B

## LEGEND



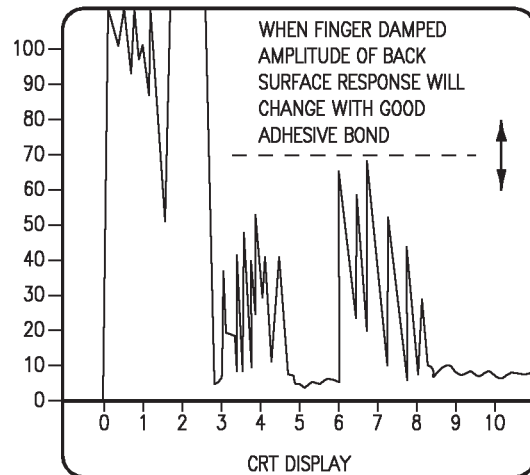
**Figure 3. Ultrasonic Inspection of Bonded Aluminum Doublers Using C-398 Ultrasonic Flaw Detector (Sheet 1)**



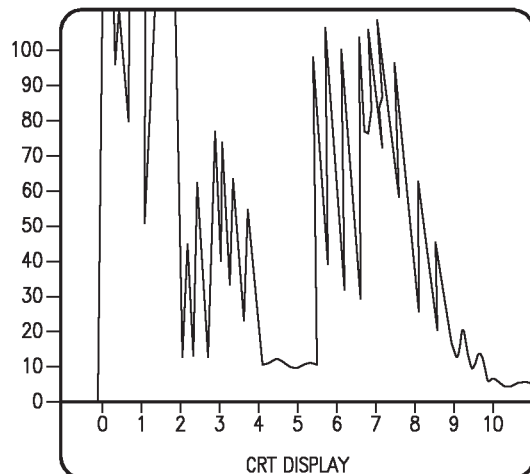
CRT 1

TYPICAL ADHESIVE BOND  
WITH 12dB GAIN ADDED

GOOD BOND  
GIVES AMPLITUDE  
CHANGE



CRT 2



CRT 3

WHEN FINGER DAMPED,  
AMPLITUDE OF BACK  
SURFACE RESPONSE  
WILL NOT CHANGE WITH  
ADHESIVE UNBOND.

**Figure 3. Ultrasonic Inspection of Bonded Aluminum Doublers Using C-398  
Ultrasonic Flaw Detector (Sheet 2)**



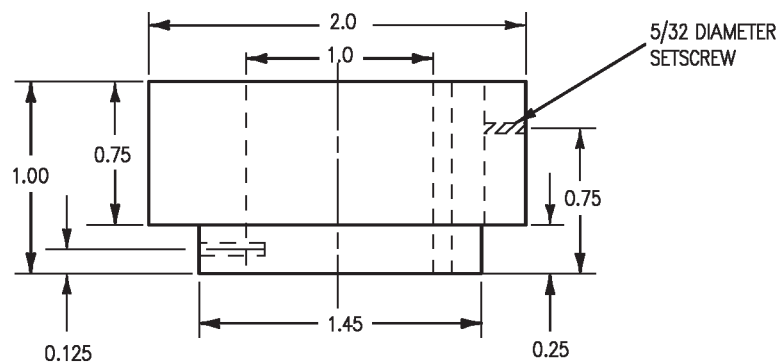
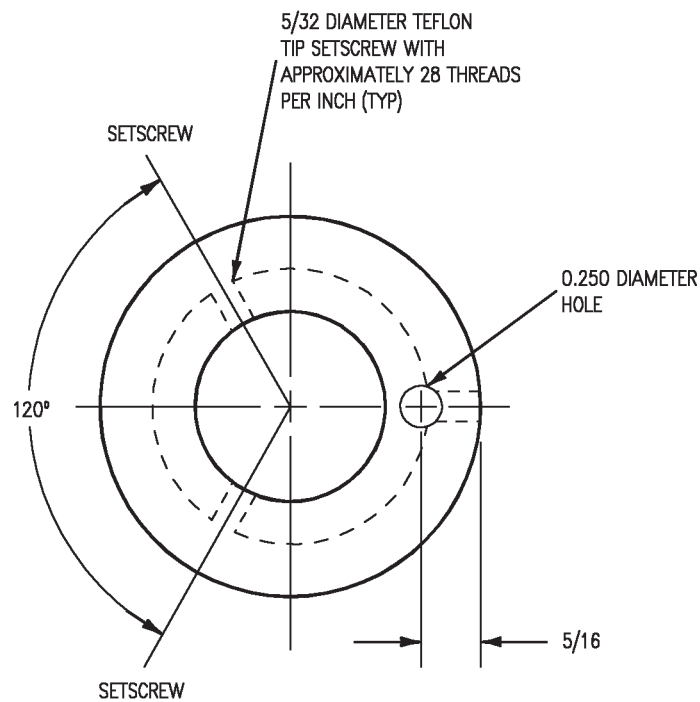


Figure 4. Teflon Eddy Current Probe Guide

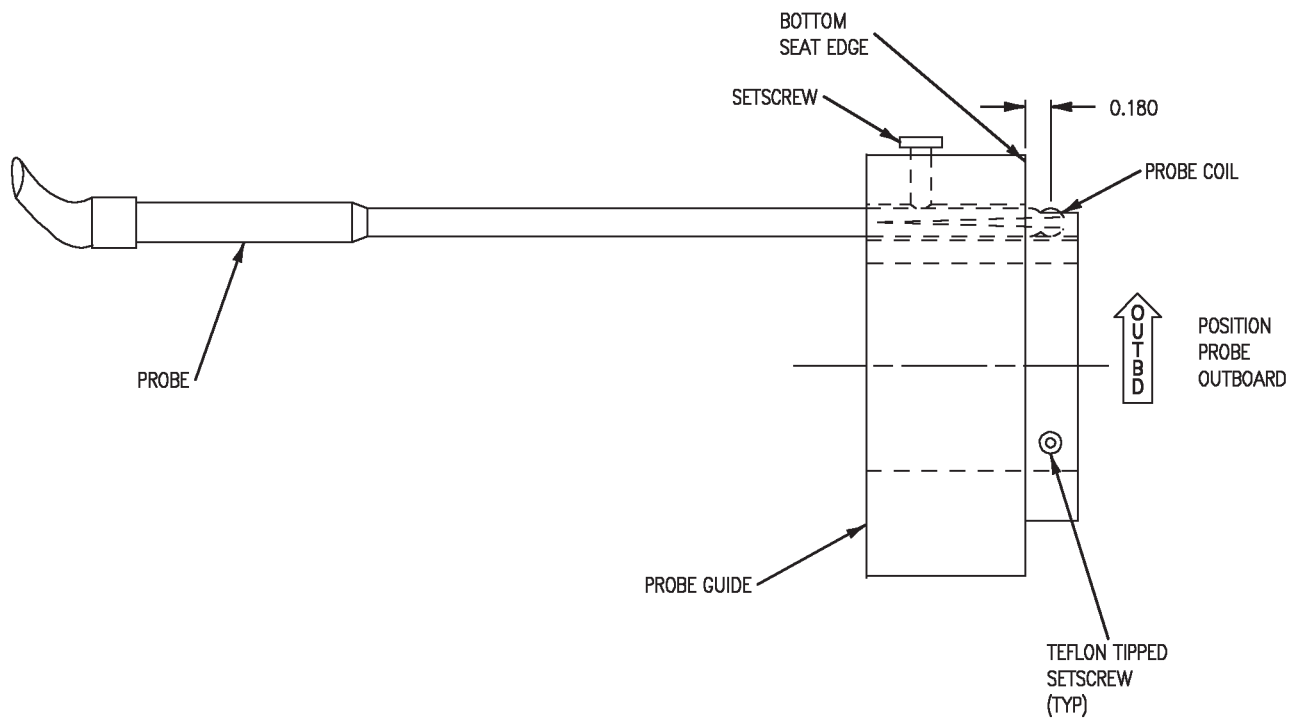


Figure 5. Probe/Probe Guide Adjustment, Setup

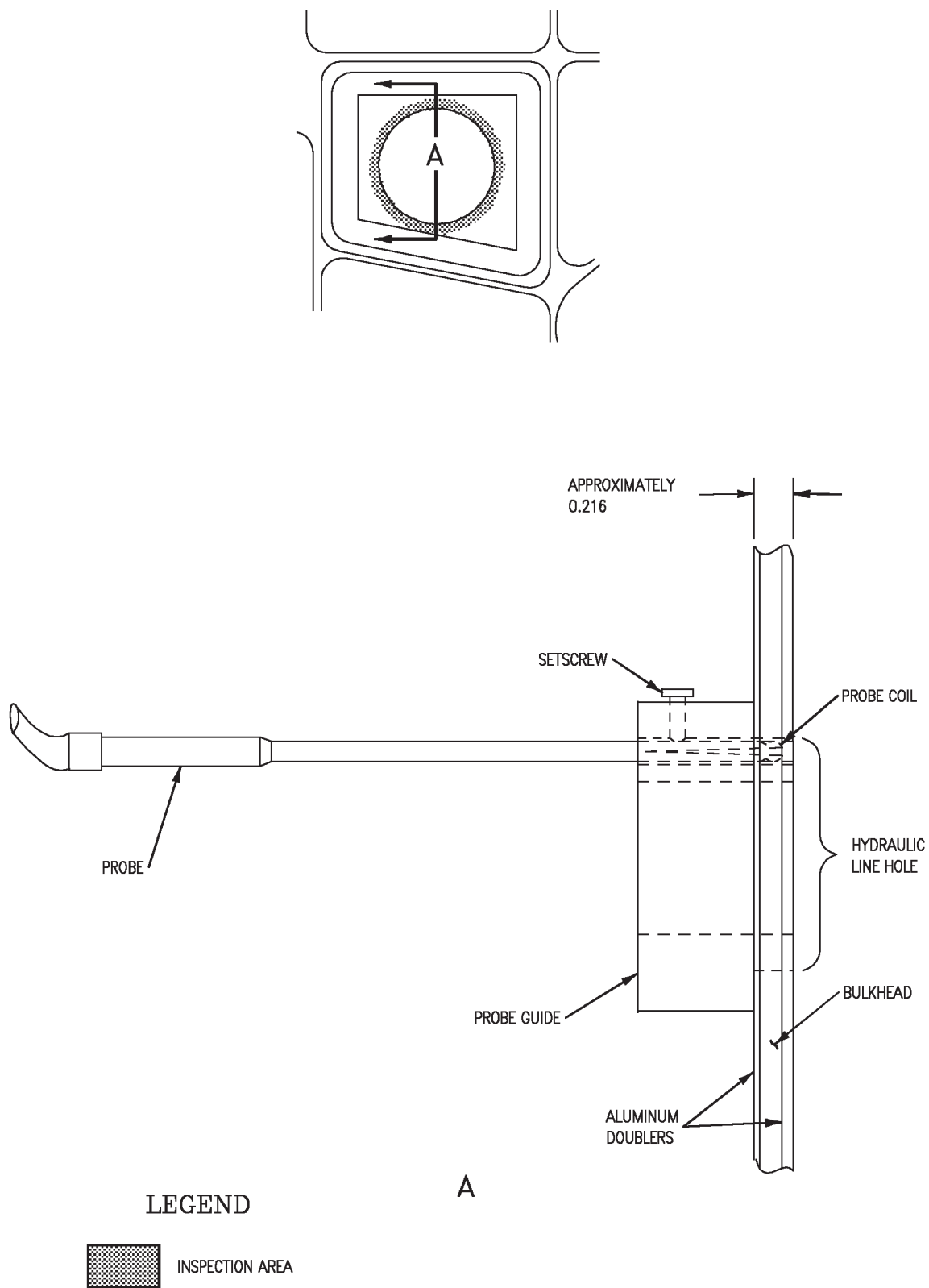
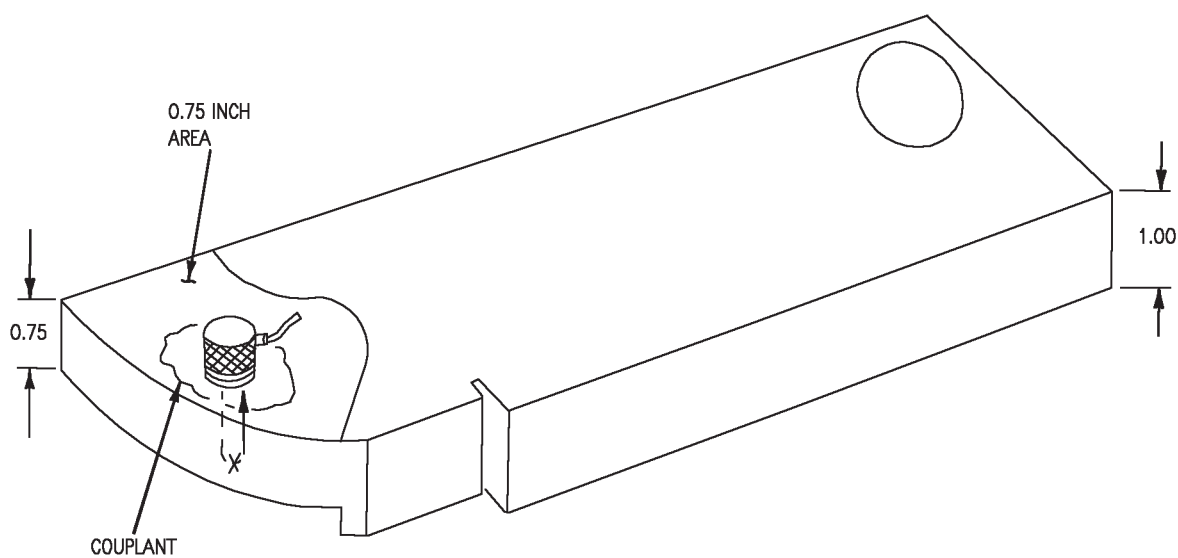
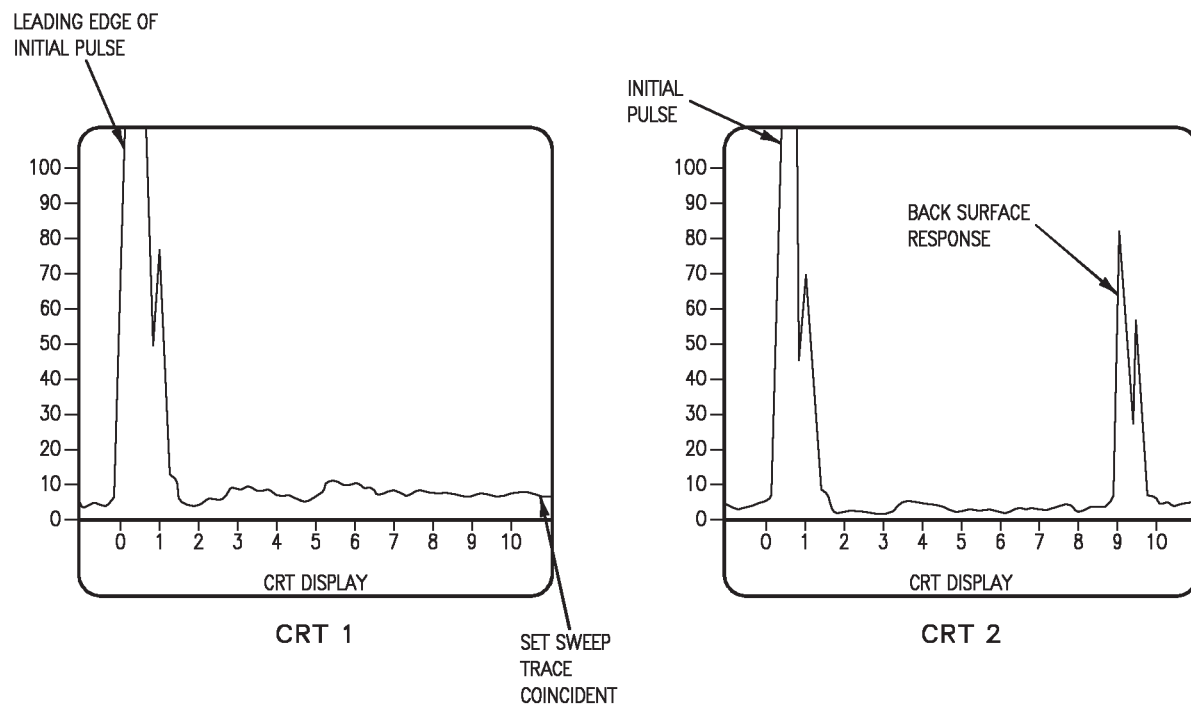
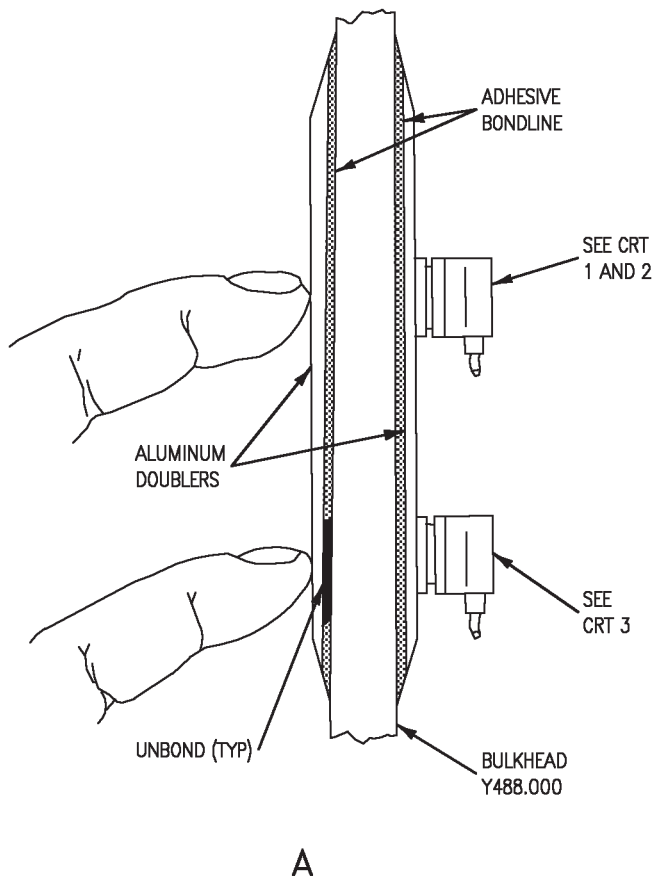
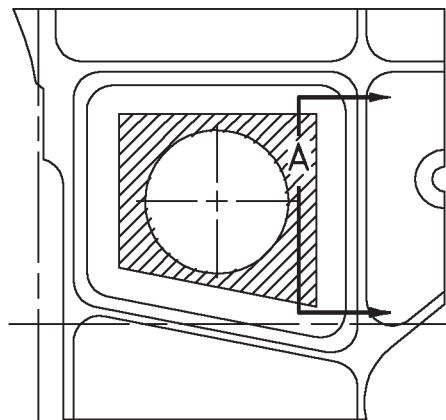


Figure 6. Hydraulic Line Hole Inspection



ALUMINUM ULTRASONIC TEST  
BLOCK, IIW-2 57A4244-30



LEGEND



Figure 8. Ultrasonic Inspection of Bonded Aluminum Doublers Using MXU -715/E  
Ultrasonic Flaw Detector



## DEPOT MAINTENANCE

## NONDESTRUCTIVE INSPECTION

## CENTER FUSELAGE BULKHEAD Y488.000, CONTROL HOLE

## FATIGUE CRACKS

PART NO. 74A324206

EFFECTIVITY: 161353 THRU 161704

## Reference Material

Naval Aviation Maintenance Program .....	OPNAVINST 4790.2
Power Plant and Related Systems .....	A1-F18AC-270-300
Removal and Installation - Middle Throttle Cables (3AAP657 or 3AAR658) .....	WP081 00
Structure Repair, Wing.....	A1-F18AC-SRM-210
Inner Wing Removal and Installation .....	WP025 00
Nondestructive Inspection.....	A1-F18AC-SRM-300
Eddy Current Surface Inspection of Aluminum Alloys .....	WP007 00

## Alphabetical Index

Subject	Page No.
Center Fuselage Bulkhead Y488.000 Control Hole.....	1
Defects .....	1
Post Inspection Cleaning and Corrosion Control.....	3
Primary Inspection Method .....	1
System Securing.....	3

## Record of Applicable Technical Directives

None

1. CENTER FUSELAGE BULKHEAD  
Y488.000 CONTROL HOLE.

2. The center fuselage bulkhead Y488.000, control hole (control hole) is machined from 7075 aluminum plate. Installed in the control hole is a force mated copper beryllium bushing. Surface finish is ion vapor deposition (IVD), aluminum, and epoxy primer coating.

3. **DEFECTS.** Inspect area around control hole for fatigue cracks, see figure 1.

4. **PRIMARY INSPECTION METHOD.** Primary inspection method is eddy current.

5. **Personnel Qualifications.** Personnel doing this nondestructive inspection should be qualified and certified to do eddy current inspections per OPNAVINST 4790.2 SERIES, NDI Technicians, NEC 7225/MOS 6044.

6. **Preparation of Aircraft.** No special preparation required.

7. **Access.**

a. Have inner wing removed  
(A1-F18AC-SRM-210, WP025 00).

b. Have middle throttle cables removed  
(A1-F18AC-270-300, WP081 00).

### Support Equipment Required

Part Number or Type Designation	Nomenclature
ED520	Eddy Current Flaw Detector, Magnatest
1RR90F-6-1/2	Right Angle Surface Probe
— Fabricate, Figure 2	Control Hole Eddy Current Probe Guide

### Materials Required

**NOTE**

Alternate item specifications or part numbers are shown indented.

Specification or Part Number	Nomenclature
P-D-680, TYPE 2 D 1153	Dry Cleaning Solvent Methyl Isobutyl Ke- tone
MIL-P-83953-2, TYPE 1, CLASS A or B, RED or BLACK	Aircraft Marking Pencil
MIL-C-87962, TYPE 1	Cleaning Cloth
MIL-P-8184	Acrylic Plastic, Sheet, Lucite Material 0.090 Thick

**WARNING**

Dry cleaning solvent and Methyl Isobutyl Ketone are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

8. **Preparation of Part.** Clean inspection area(s) with a solvent moistened cloth to make sure inspection areas are free of contamination or foreign material.

9. **Equipment Settings/Standardization/Setup.**

Do ED520 Flaw Detector Setup (WP007 00) using 1RR90F-6-1/2 right angle surface probe, (probe) which is part of the 74D110193-1001 eddy current probe set.

10. **Inspection Procedure.** Do Inspection Procedure (WP007 00) and as below:

**NOTE**

Do not remove bushing.

a. Position probe guide, see figure 2, in control hole from side of bulkhead to be inspected so edge of bushing is covered.

b. Position probe in flat smooth area away from bushing and use BALANCE to set meter needle to 250 microamperes.

**NOTE**

When probe is moved near edge of part or control hole bushing, meter needle may gradually move down scale. If required, use BALANCE to return meter needle to 250 microamperes and scan parallel to edge or radius.

c. Scan part in directions shown in figure 1. Scan at constant speed, no faster than speed used for standardizing equipment. After each scan, index 1/2 probe diameter 90° to scan direction and repeat until complete area has been scanned in required directions, see figure 1.



d. Mark area(s) with aircraft marking pencil where sharp down scale deflection of meter needle indicates crack and record.

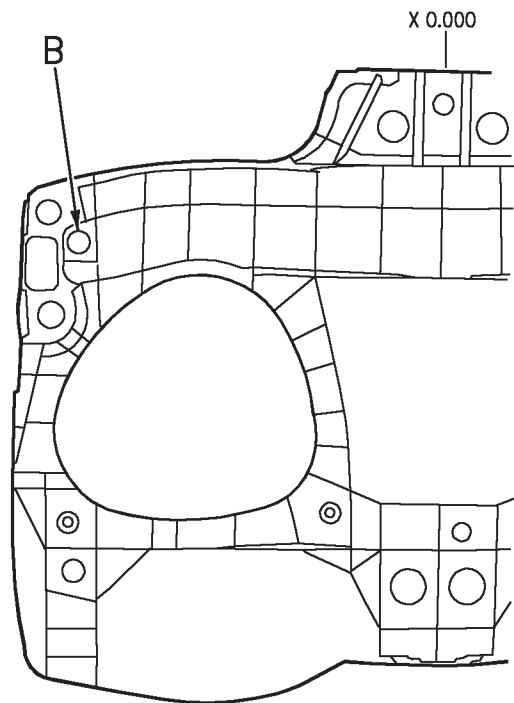
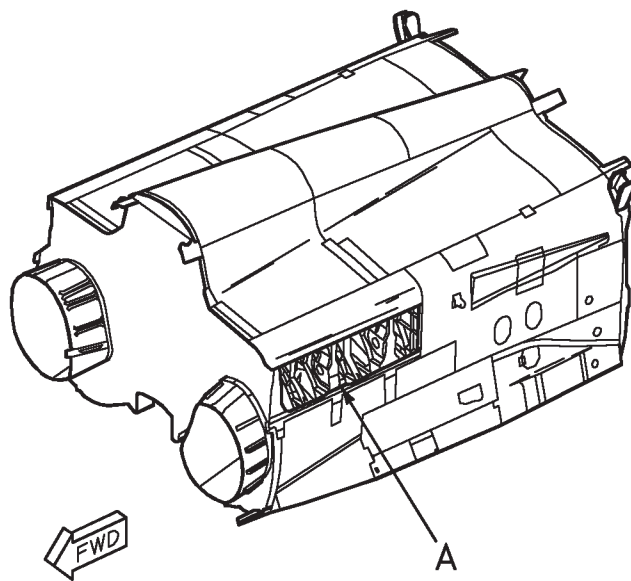
e. Repeat steps a. through d. and Inspection Procedure (WP007 00) for opposite side of bulkhead.

**11. POST INSPECTION CLEANING AND CORROSION CONTROL.** Clean inspection marks, if required, from inspection area(s).

## 12. SYSTEM SECURING.

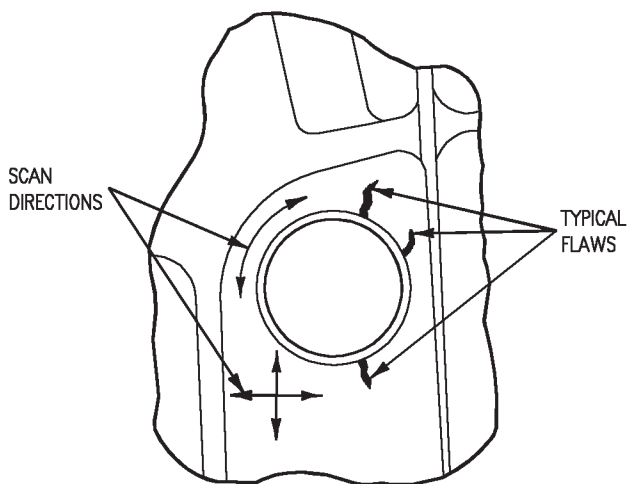
a. Have middle throttle cables reinstalled (A1-F18AC-270-300, WP081 00).

b. Have inner wing reinstalled (A1-F18AC-SRM-210, WP025 00).



LOOKING FORWARD

A



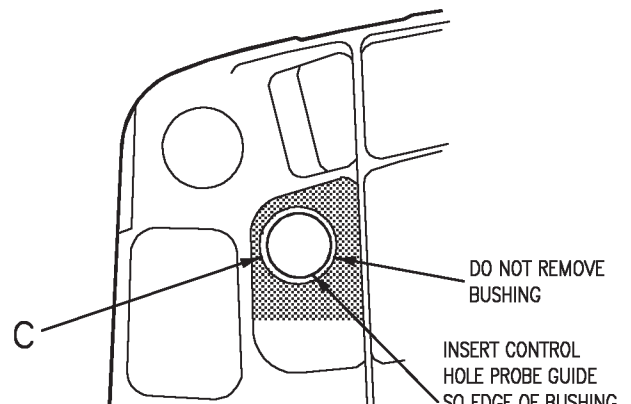
INSPECT FORWARD  
AND AFT SURFACES

C

## LEGEND

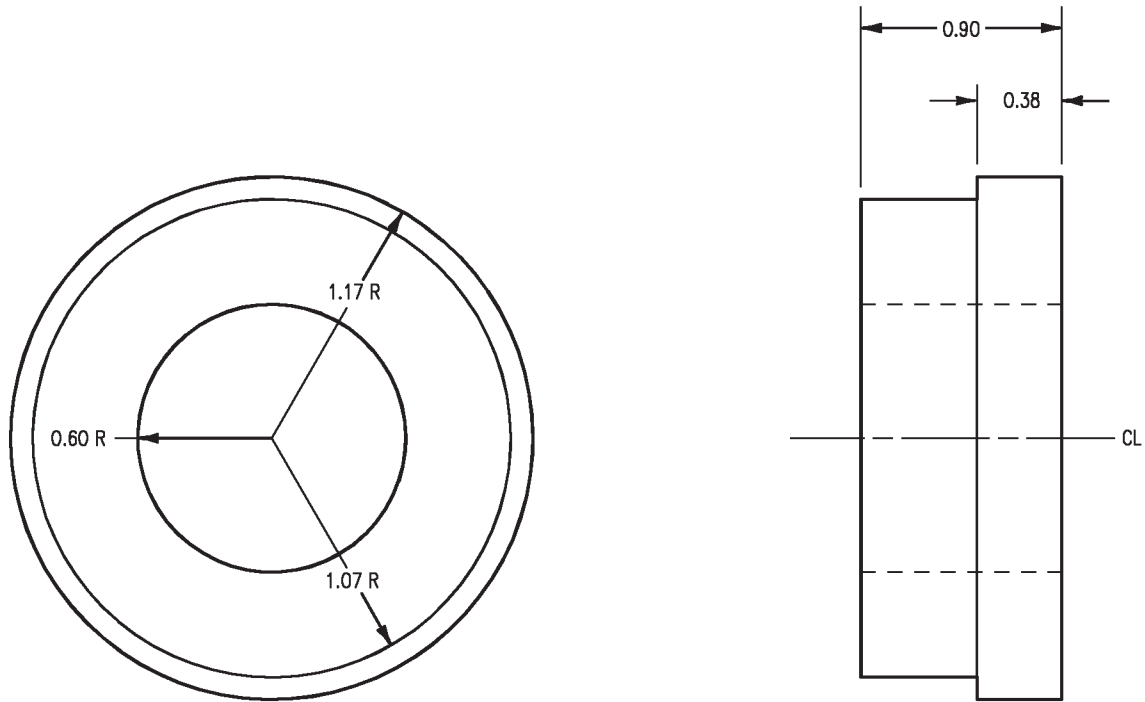


INSPECTION AREA



B

**Figure 1. Center Fuselage Bulkhead Y488.000, Control Hole Inspection Area, Scan Directions, and Typical Flaws**



ACRYLIC PLASTIC

**Figure 2. Control Hole Eddy Current Probe Guide**



## INTERMEDIATE MAINTENANCE

## NONDESTRUCTIVE INSPECTION

CENTER FUSELAGE BULKHEAD Y488.000, INNER WING LOWER LUG  
ATTACH POINT; OUTBOARD, FATIGUE CRACKS

PART NO. 74A324206

EFFECTIVITY: 161353 THRU 161718

## Reference Material

Naval Aviation Maintenance Program .....	OPNAVINST 4790.2
Line Maintenance Access Doors .....	A1-F18AC-LMM-010
Nondestructive Inspection .....	A1-F18AC-SRM-300
Eddy Current Surface Inspection of Aluminum Alloys .....	WP007 00
Structure Repair, Wing .....	A1-F18AC-SRM-210
Inner Wing Removal and Installation .....	WP025 00

## Alphabetical Index

Subject	Page No.
Center Fuselage Bulkhead Y488.000, Inner Wing Lower Lug Attach Point .....	1
Defects .....	1
Primary Inspection Method .....	1
System Securing .....	3

## Record of Applicable Technical Directives

None

1. **CENTER FUSELAGE BULKHEAD  
Y488.000, INNER WING LOWER LUG  
ATTACH POINT.**

2. Center fuselage bulkhead Y488.000, inner wing lower lug attach point (attach point) is machined from 7075 aluminum plate. Installed in attach point is a force mated copper beryllium bushing. Surface finish is ion vapor deposition (IVD) aluminum and epoxy primer coating.

3. **DEFECTS.** Inspect area around attach point for fatigue cracks, see figure 1.

4. **PRIMARY INSPECTION METHOD.** Primary inspection method is eddy current.

5. **Personnel Qualifications.** Personnel doing this nondestructive inspection should be qualified and certified to do eddy current inspections per OPNAVINST 4790.2 SERIES, NDI Technicians, NEC 7225/MOS 6044.

6. **Preparation of Aircraft.** No special preparation required.

7. **Access.**

a. Have doors 41 L/R and 44 L/R removed (A1-F18AC-LMM-010).

b. Have match angle removed  
(A1-F18AC-SRM-210, WP025 00).

## Support Equipment Required

### NOTE

Alternate item type designations or part numbers are shown in parentheses.

Part Number or Type Designation	Nomenclature
ED520	Eddy Current Flaw Detector, Magna test
VM-89A	Eddy Current Reference Standard, Aluminum
6193	Multiple Coil Eddy Current Probe, Ideal Specialty Co.
MP901-60 (1RR90F-6-1/8)	Right Angle Eddy Current Surface Probe, G.K. Engineering

## Materials Required

### NOTE

Alternate item specifications or part numbers are shown indented.

Specification or Part Number	Nomenclature
P-D-680, TYPE 2 D 1153	Dry Cleaning Solvent Methyl Isobutyl Ke- tone
MIL-P-83953-2, TYPE 1, CLASS A or B RED or BLACK	Aircraft Marking Pencil
MIL-C-87962, TYPE 1	Cleaning Cloth

### WARNING

Dry cleaning solvent and methyl isobutyl ketone are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

8. **Preparation of Part.** Clean inspection areas with solvent moistened cloth to make sure inspection areas are free of contamination or foreign material.

### 9. Equipment Settings/Standardization/Setup.

a. For flat open areas between lower wing skin fitting and longeron, see figure 1, do ED520 Flaw Detector Setup (WP007 00) except as below:

(1) Use 6193 multiple coil surface probe.

(2) Use 0.01 deep notch in reference standard to standardize, see figure 2.

(3) Meter needle deflection should be at least 100 microamperes.

b. For area from centerline of attach point to 1/2-inch below inner wing fitting and forward and aft flange radii, see figure 1, do ED520 Flaw Detector Setup (WP007 00) except as below:

(1) Use MP901-60 right angle surface probe.

(2) Use same reference standard and standardization sensitivity as in paragraph 9, step 2.

### 10. Inspection Procedure.

a. For flat open areas, see figure 1, do Inspection Procedure (007 00) except as below:

(1) Position 6193 multiple surface probe on flat, smooth surface in inspection area.

(2) Use BALANCE to set meter needle at 250 microamperes.

## NOTE

When probe is moved near edge of part, fastener hole, or radius, meter needle may gradually move up or down scale.

(3) Use BALANCE to return meter needle to 250 microamperes and scan parallel to edge or radius.

(4) Scan part in direction shown in figure 1. Scan slowly and at constant speed, no faster than speed used for standardizing equipment. After each scan, index 3/8-inch 90° to scan direction and repeat until area has been scanned.

(5) Mark area(s) with aircraft marking pencil where sharp down scale deflection of meter needle exceeds 50 microamperes.

(6) Use MP901-60 right angle surface probe and WP007 00 to reinspect all marked areas to more accurately locate defects. Reject all areas where sharp down scale deflection of meter needle exceeds 100 microamperes.

b. For area from centerline of attach point to 1/2-inch below inner wing fitting and forward and

aft flange fittings, see figure 1, do Inspection Procedure (WP007 00) except as below:

(1) Position MP901-60 probe on flat, smooth surface in inspection area.

(2) Use balance to set meter needle at 250 microamperes.

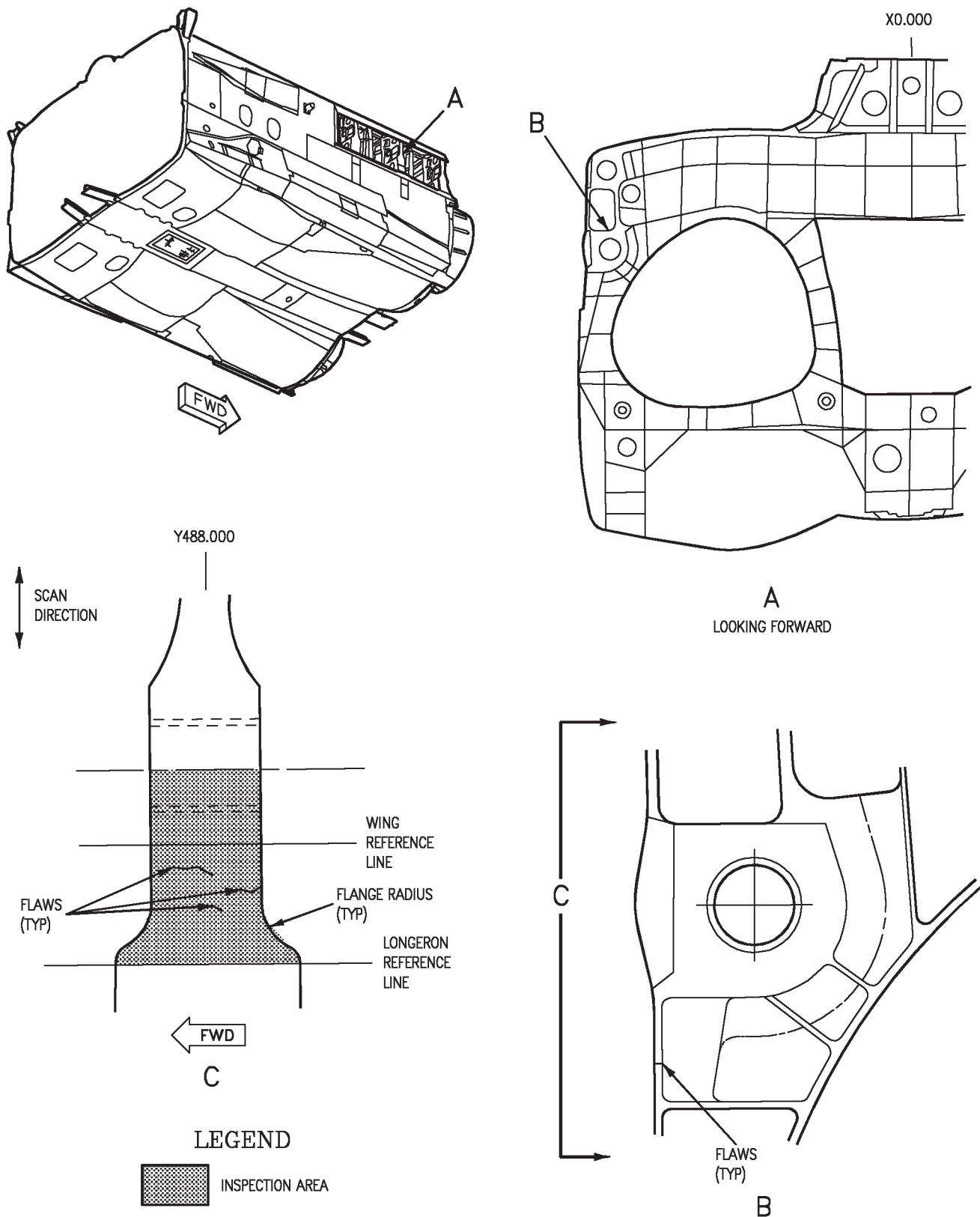
(3) Scan part in direction shown in figure 1. Scan slowly at constant speed, no faster than speed used for standardizing equipment. Use non-metallic straight edge, when possible, to stabilize probe during scan. After each scan, index 1/16-inch 90° to scan direction and repeat until complete area has been scanned.

(4) Reject all areas where sharp down scale deflection of meter needle exceeds 100 microampres.

## 11. SYSTEM SECURING.

a. Have match angles reinstalled (A1-F18AC-SRM-210, WP025 00).

b. Have doors 41 L/R and 44 L/R reinstalled (A1-F18AC-LMM-010).



**Figure 1. Center Fuselage Bulkhead Y488.000, Inner Wing Lower Lug Attach Point; Outboard Inspection Area, Scan Direction, and Typical Flaws (Sheet 1)**



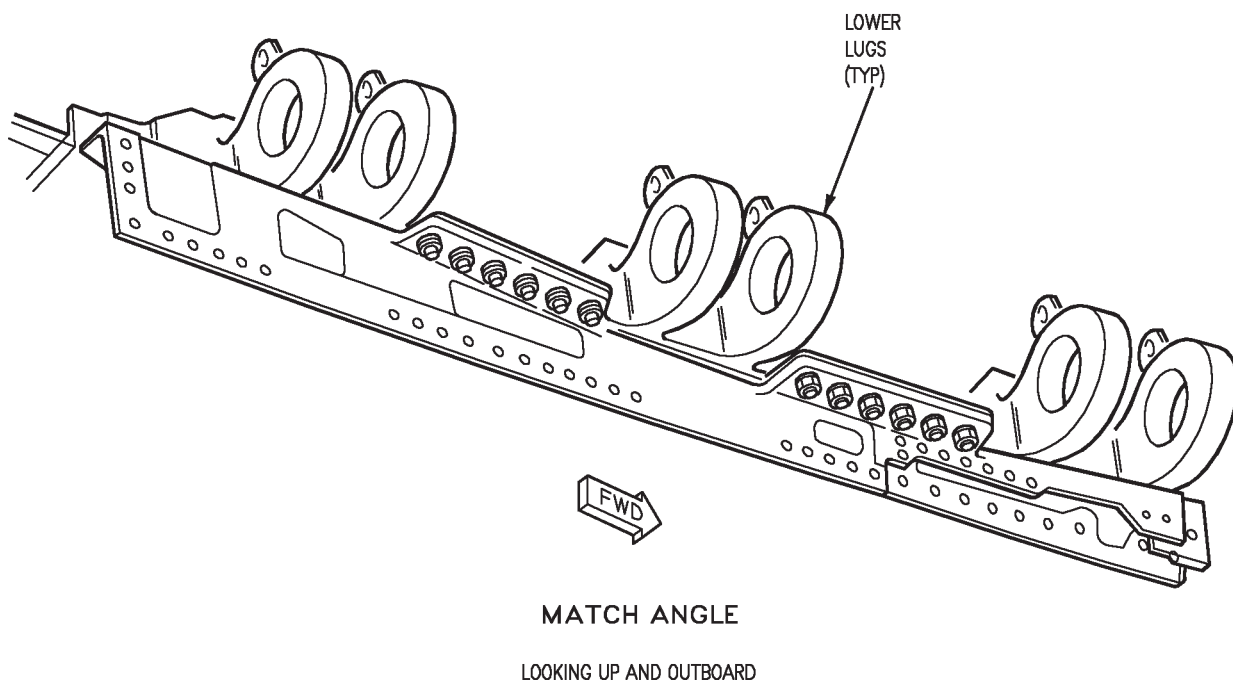
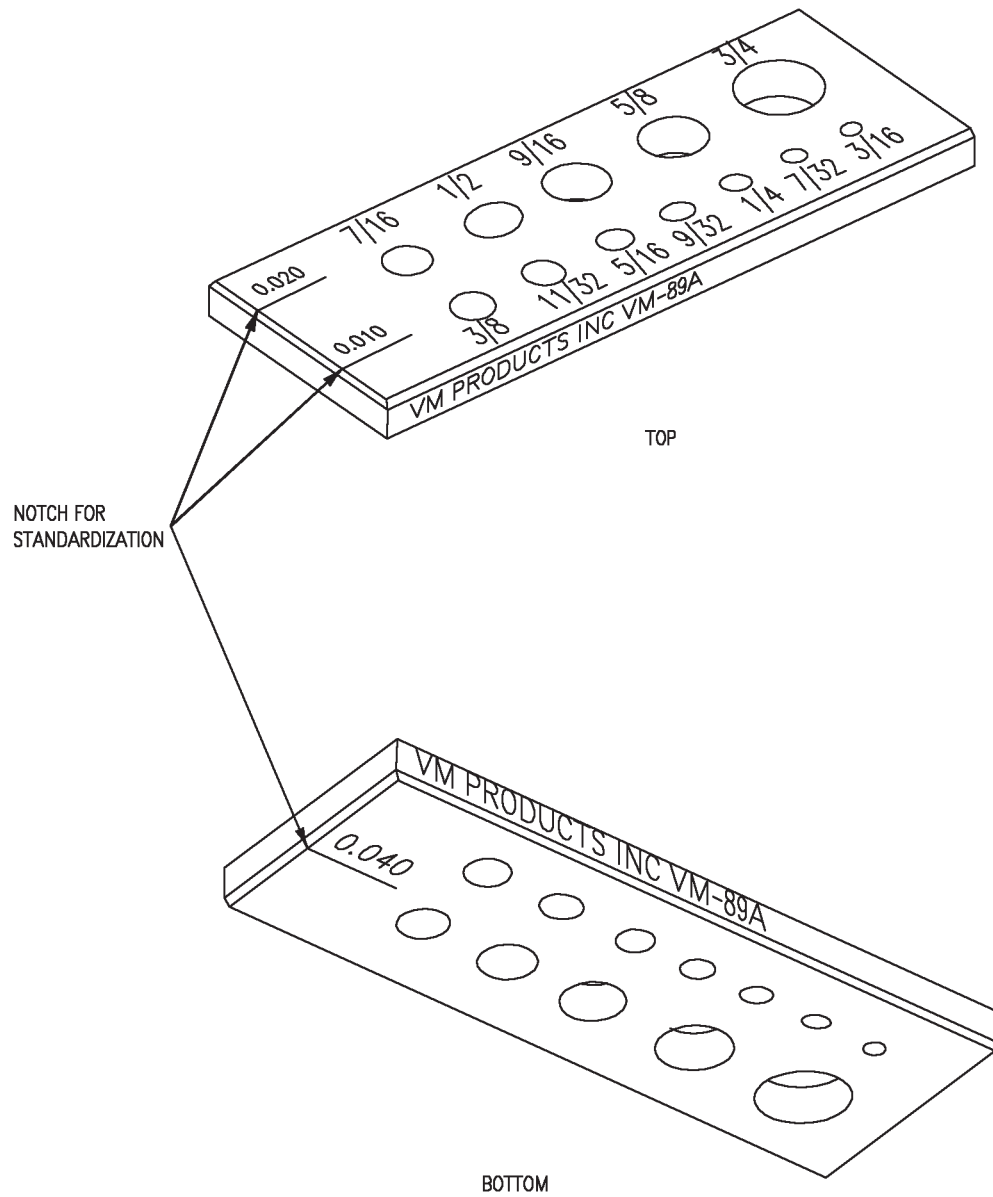


Figure 1. Center Fuselage Bulkhead Y488.000, Inner Wing Lower Lug Attach Point; Outboard Inspection Area, Scan Direction, and Typical Flaws (Sheet 2)



EDM NOTCH HOLE REFERENCE STANDARD ALUMINUM

**Figure 2. Eddy Current Reference Standard**

## INTERMEDIATE MAINTENANCE

## NONDESTRUCTIVE INSPECTION

## CENTER FUSELAGE Y526.000 TO Y534.000, LOWER OUTBOARD LONGERON AND SKIN INSPECTION

## Reference Material

Naval Aviation Maintenance Program .....	OPNAVINST 4790.2
Aircraft Corrosion Control.....	A1-F18AC-SRM-500
Aft Center Fuselage Finish System and Markings .....	WP033 00
Structure Repair, General Information .....	A1-F18AC-SRM-200
Fasteners .....	WP004 06
Nondestructive Inspection.....	A1-F18AC-SRM-300
Eddy Current Hole Inspection of Aluminum Alloys .....	WP007 01
Plane Captain Manual .....	A1-F18AC-PCM-000
Structural Hardware.....	NAVAIR 01-1A-8

## Alphabetical Index

Subject	Page No.
Center Fuselage Y526.000 to Y534.000, Lower Outboard Longerons and Skin .....	1
Defects .....	1
Primary Inspection Method .....	1
System Securing.....	3

## Record of Applicable Technical Directives

None

### 1. CENTER FUSELAGE Y526.000 to Y534.000, LOWER OUTBOARD LONGERON AND SKIN.

2. The lower outboard longeron is made of 7149-T73511 aluminum alloy. Finish system is ion vapor deposition (IVD), epoxy primer, and polyurethane paint. The skin, is made of 7075-T76 aluminum clad sheet. Finish system is conversion coating and epoxy primer.

3. **DEFECTS.** Inspect 8 fastener holes in lower outboard longeron and skin area for fatigue cracks, see figure 1.

4. **PRIMARY INSPECTION METHOD.** Primary inspection method is eddy current.

5. **Personnel Qualifications.** Personnel doing this non-destructive inspection should be qualified and certified to do eddy current inspections per OPNAVINST 4790.2 SERIES, NDI Technicians, NEC 7225/MOS 6044.

6. **Preparation of Aircraft.** No special preparation required.

#### 7. Access.

a. Have skin trimmed to edge of angle, see detail A.

b. Have 8 fasteners removed, see detail F, Jo-Bolts (NAVAIR 01-1A-8, Section I, Rivets) and Hi-Loks (A1-F18AC-SRM-200, WP004 06).

**Support Equipment Required**

Part Number or Type Designation	Nomenclature
ED520	Eddy Current Flaw Detector
VM89A	EDM Notch Bolt Hole Reference Standard, Aluminum
64101-1/4	Bolt Hole Probe and Collar, 0.25 Dia., Ideal Speciality

**Materials Required****NOTE**

Alternate item specifications or part numbers are shown indented.

Specification or Part Number	Nomenclature
P-D-680, TYPE 2 D 1153	Dry Cleaning Solvent Methyl Isobutyl Ke- tone
MIL-P-83953-2, TYPE 1, CLASS A or B, RED or BLACK	Aircraft Marking Pencil
MIL-C-87962, TYPE 1	Cleaning Cloth

**WARNING**

Dry cleaning solvent and methyl isobutyl ketone are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

**8. Preparation of Part.** Clean inspection area with solvent moistened cloth to make sure inspection area is free of contamination or foreign material.

**WARNING**

Make sure safety precautions are met for electrical, static, grounding when using eddy current equipment near aircraft fuel cells, oxygen systems, electrical systems, electronic systems, and stores (A1-F18AC-PCM-000).

**9. Equipment Settings/Standardization/Setup.** Do ED520 Flaw Detector Setup (WP007 01) and steps below:

- a. Connect the 0.25 bolt hole probe to flaw detector.
- b. After lift-off compensation is confirmed, set FUNC to MED.
- c. Use 0.25 dia hole and 0.002 wide  $\times$  0.060 corner notch in bolt hole reference standard to get 300 microamperes needle deflection.

**10. Inspection Procedure.** Do Inspection Procedure (WP007 01) and steps below:

- a. Position probe in collar with center of coil approximately 0.070 from collar edge.
- b. Insert probe into hole, see detail E.
- c. Adjust meter needle to 250 microamperes with BALANCE.
- d. Scan hole by rotating probe at constant rate, no more than rate needed to get flaw response on bolt reference standard.
- e. Scan hole indexing probe at increasing depths not exceeding 1/16-inch depth.

**NOTE**

Sharp needle movements down scale are characteristic of crack indications.

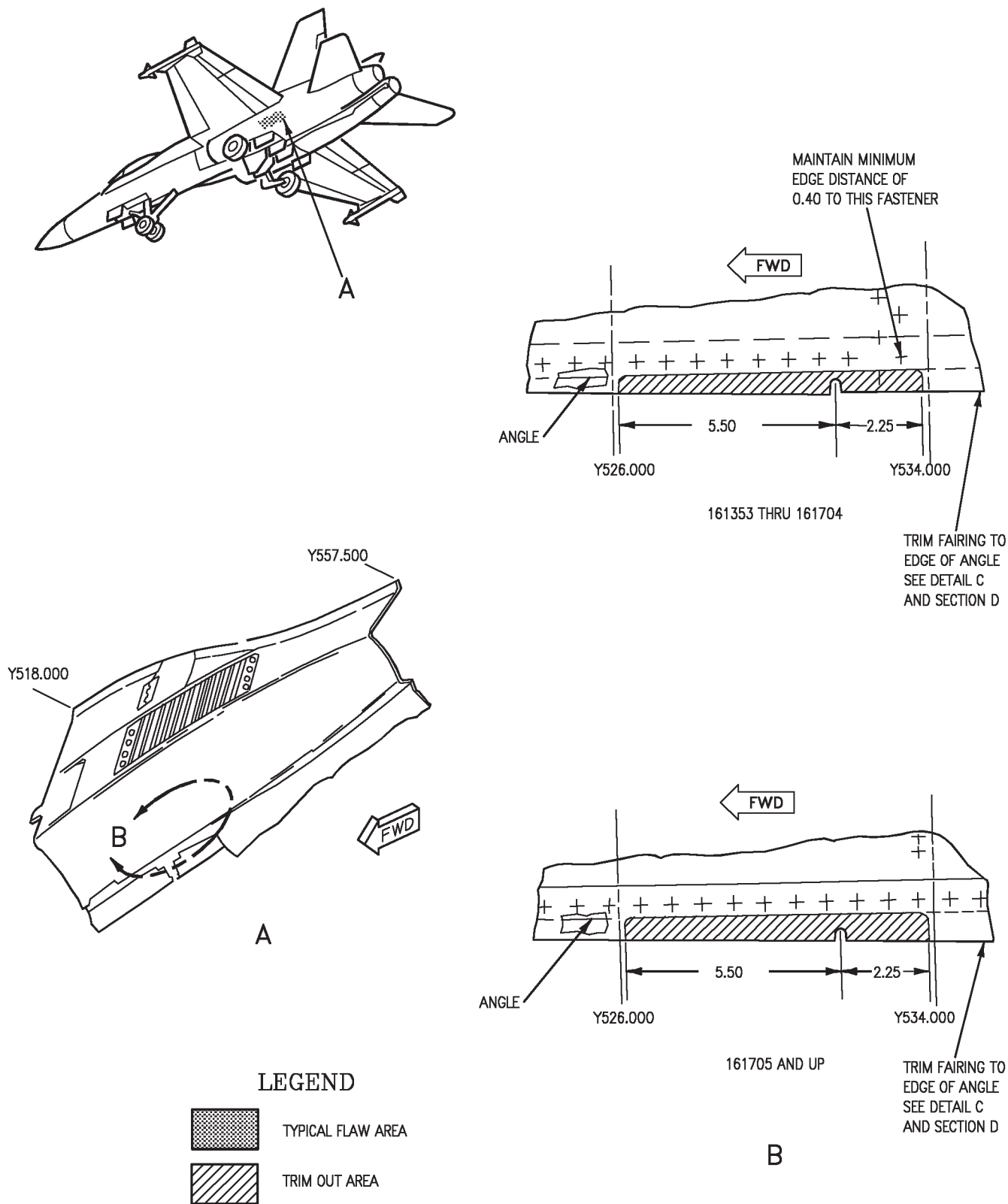
f. Reset balance point to 250 microamperes with BALANCE after each depth interval.

b. Refinish inspection area (A1-F18AC-SRM-500, WP033 00).

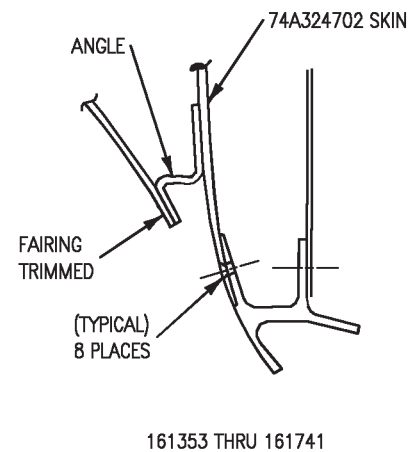
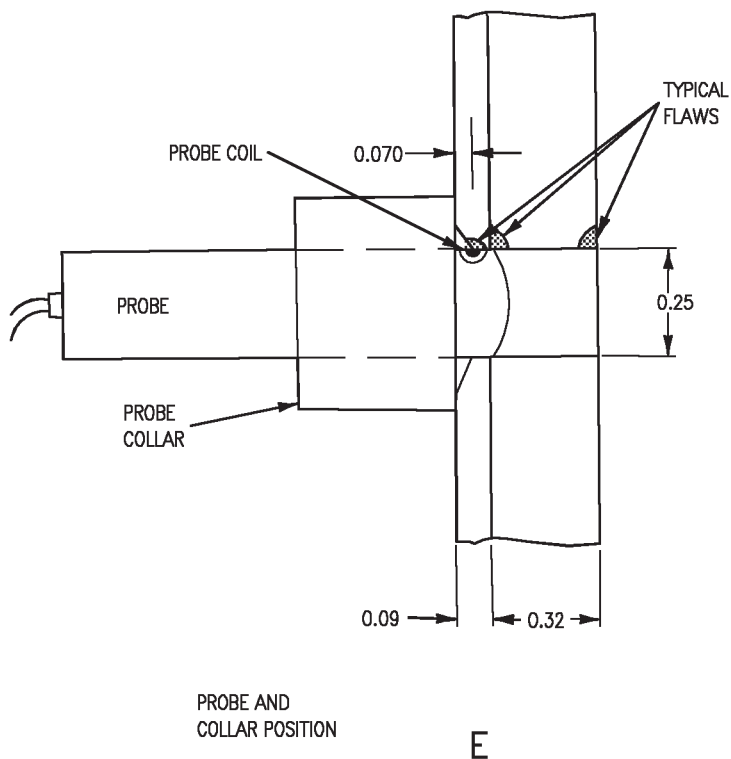
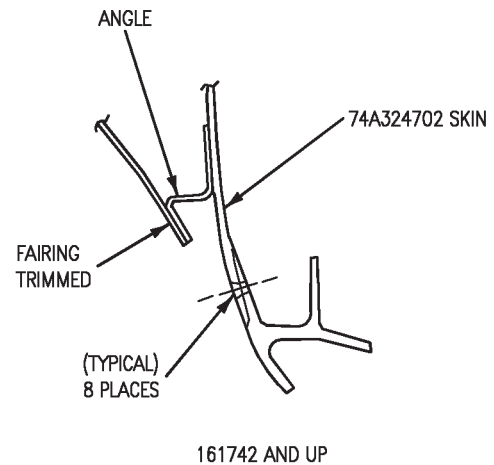
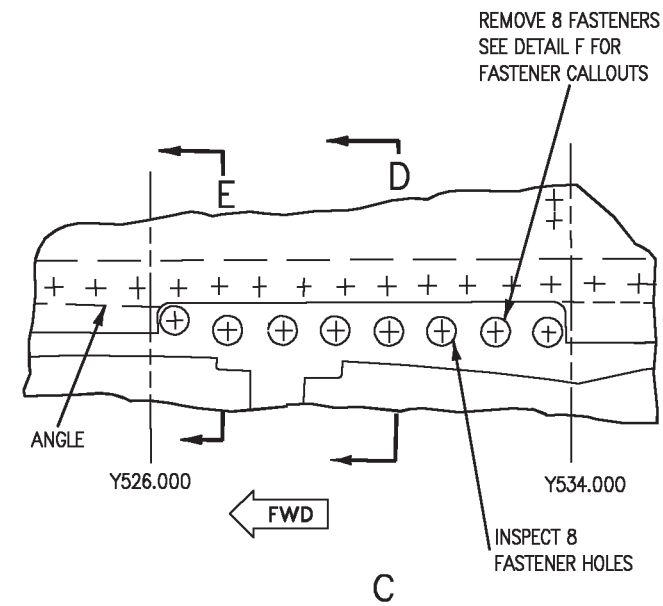
g. Mark all suspect flaw indications with an aircraft marking pencil and record.

## 11. SYSTEM SECURING.

a. Have fasteners reinstalled see detail F, Jo-Bolts (NAVAIR 01-1A-8, Section I, Rivets) and Hi-Loks (A1-F18AC-SRM-200, WP004 06).

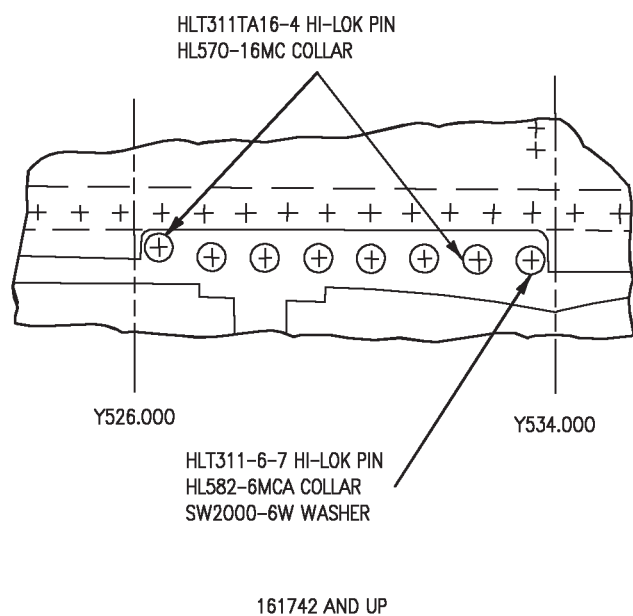
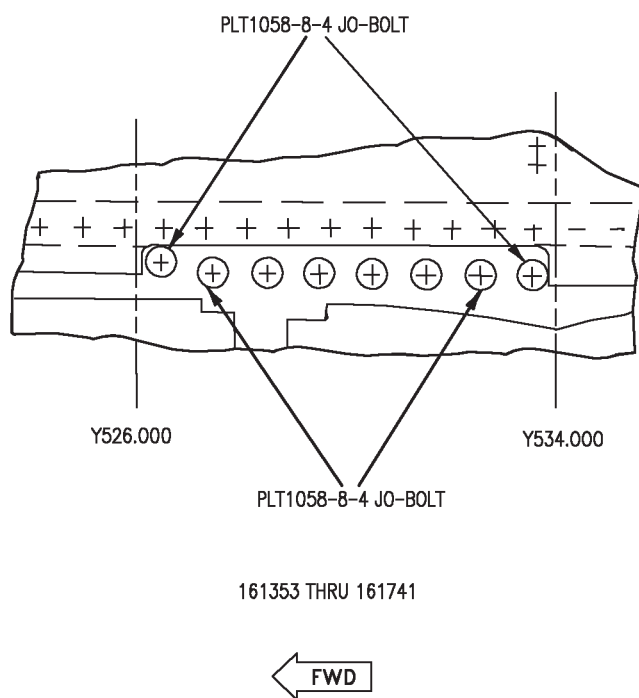


**Figure 1. Center Fuselage Y526.000 to Y534.000, Lower Outboard Longerons and Skin Inspection (Sheet 1)**



D

**Figure 1. Center Fuselage Y526.000 to Y534.000, Lower Outboard Longerons and Skin Inspection (Sheet 2)**



F

**Figure 1. Center Fuselage Y526.000 to Y534.000, Lower Outboard Longeron and Skin Inspection (Sheet 3)**



## INTERMEDIATE MAINTENANCE

## NONDESTRUCTIVE INSPECTION

## HORIZONTAL STABILATOR SPINDLE FATIGUE CRACKS

PART NO. 74A331802

This WP supersedes WP042 00, dated 1 April 1993.

## Reference Material

Naval Aviation Maintenance Program .....	OPNAVINST. 4790.2
Line Maintenance Access Doors .....	A1-F18AC-LMM-010
Integrated Flight Controls .....	A1-F18AC-570-300
Stabilator (84MPS529 or 84MPT530) .....	WP021 00
Nondestructive Inspection .....	A1-F18AC-SRM-300
Magnetic Particle Method .....	WP006 00
Ultrasonic Method .....	WP008 00
Ultrasonic Pulse-Echo Shear Wave Inspection of Metallic Materials .....	WP008 09
Plane Captain Manual .....	A1-F18AC-PCM-000

## Alphabetical Index

Subject	Page No.
Horizontal Stabilator Spindle .....	1
Defects .....	1
Magnetic Particle Method .....	2
Post Inspection Cleaning and Corrosion Control .....	6
Primary Inspection Methods .....	1
System Securing .....	6
Ultrasonic Method Using C-398 Ultrasonic Flaw Detector .....	3
Ultrasonic Method Using MXU-715/E Ultrasonic Flaw Detector .....	5

## Record of Applicable Technical Directives

None

## 1. HORIZONTAL STABILATOR SPINDLE.

2. Horizontal stabilator spindle (spindle) is machined high strength steel forging. Spindle is cadmium plated and finished with epoxy primer and polyurethane coatings.

3. **DEFECTS.** Inspect spindle shaft and transition areas between base block and forward lugs for fatigue cracks. See figure 1.

4. **PRIMARY INSPECTION METHODS.** There are two primary inspection methods, ultrasonic and magnetic particle.

5. **Personnel Qualifications.** Personnel doing this nondestructive inspection should be qualified and certified to do ultrasonic and magnetic particle inspections per OPNAVINST 4790.2 SERIES, NDI Technicians, NEC 7225/MOS 6044.

6. **Preparation of Aircraft.** No special preparation required.

7. **Access.**

a. Remove doors 72 and 73, left and right (A1-F18AC-LMM-010).

**CAUTION**

Do not remove spindle bushings or strain gages, damage may result.

b. Remove horizontal stabilator (A1-F18AC-570-300, WP021 00).

8. **MAGNETIC PARTICLE METHOD.**

**Support Equipment Required**

**NOTE**

Alternate item type designations or part numbers are listed in parentheses.

Part Number or Type Designation	Nomenclature
DA200	Magnetic Inspection Probe
M-16 (ZB-26)	Black Light

**Materials Required**

Specification or Part Number	Nomenclature
020X413	Cleaning Compound
14AM	Magnetic Inspection Compound
A-A-883, TYPE 1, 1/2IN	Tape, Pressure Sensitive
M83953-1 or -2	Pencil, Aircraft Marking
MILC87962TYPE1	Cloth, Cleaning

**WARNING**

Cleaning compound is flammable liquid and vapor. May cause allergic respiratory and skin reaction. May cause eye, skin and respiratory irritation. Keep away from heat, sparks, and flame. Do not breathe dust (vapor, mist, gas). Use only with adequate ventilation. Keep container closed. Avoid contact with eyes, skin and clothing. Wash thoroughly after handling.

9. **Preparation of Part.** Clean inspection area(s) of contamination or foreign material using cleaning cloth moistened with cleaning compound. Allow surface to air dry 15 minutes.

**WARNING**

Make sure safety precautions are met for electrical, static, grounding when using eddy current equipment near aircraft fuel cells, oxygen systems, electrical systems, electronic systems, and stores (A1-F18AC-PCM-000).

10. **Equipment Settings/Standardization/Setup.** Do Equipment Settings/Standardization/Setup for Longitudinal Magnetization Using Magnetic Inspection Probe (Probe) (WP006 00) except; set AC/DC switch to AC.

11. **Inspection Procedure.** Do Inspection Procedure For True Continuous Longitudinal Magnetization Using Electromagnetic Probe (WP006 00) except as below:

a. Mask bearing surfaces and other areas next to inspection using pressure sensitive tape.

b. Darken area for part inspection.

c. Position probe on spindle at inspection position 1, see figure 2.

**WARNING**

Magnetic inspection compound may cause eye and skin irritation. Avoid contact with eyes, skin and clothing. Wash thoroughly after handling.

**CAUTION**

Probe method of magnetization shall be used. Pass no current through parts to avoid possible arc burns.

Avoid overheating of probe. Do not exceed duty cycle. Duty cycle is 2 minutes on, 2 minutes off.

d. Apply magnetic inspection compound to inspection area and immediately press ON to magnetize part.

e. Current shall remain on while inspecting.

f. Using black light and magnifier, inspect for cracks. Inspection areas and typical cracks are shown in figure 1.

g. Mark location of all crack indications with aircraft marking pencil.

h. Reposition probe for inspection positions 2 through 12, as shown in figure 2. Repeat steps d through g until all positions are inspected.

i. Demagnetize. Do Demagnetization (WP006 00).

j. Reposition probe for second flux direction, inspection positions 13, 14 and 15. See figure 2. Do each position six times by indexing probe outboard along shaft of spindle 2 inches each shot and repeating steps d through g.

k. Demagnetize. Do Demagnetization (WP006 00).

l. Reposition probe for third flux direction, inspection positions 16 through 19, see figure 2, and repeat steps d through g.

m. Demagnetize. Do Demagnetization (WP006 00).

n. Do paragraphs 20 and 21.

## 12. ULTRASONIC METHOD USING C-398 ULTRASONIC FLAW DETECTOR.

### Support Equipment Required

#### NOTE

Alternate item type designations or part numbers are listed in parentheses.

#### Part Number or Type Designation

#### Nomenclature

C-398 (303B)

Ultrasonic Flaw  
Detector

57A2271 or  
EQUIVALENT  
Fabricate,  
Figure 3

Microdot to BNC  
Connecting Cable  
52°, 2.44 Radius,  
Horizontal Spindle  
Ultrasonic  
Inspection Wedge

224-580

K.B. Aerotech,  
Shear Wave,  
0.250 Dia., 5.0 MHz,  
Removable Wedge  
Search Unit

### Materials Required

#### Specification or Part Number

#### Nomenclature

ULTRAGEL II  
M83953-1 or -2

Ultrasonic Couplant  
Pencil, Aircraft  
Marking

020X413  
CCCC46TY1CL4

Cleaning Compound  
Cloth, Cleaning

**WARNING**

Cleaning compound is flammable liquid and vapor. May cause allergic respiratory and skin reaction. May cause eye, skin and respiratory irritation. Keep away from heat, sparks, and flame. Do not breathe dust (vapor, mist, gas). Use only with adequate ventilation. Keep container closed. Avoid contact with eyes, skin and clothing. Wash thoroughly after handling.

13. **Preparation of Part.** Clean inspection area(s) of contamination or foreign material using cleaning cloth moistened with cleaning compound. Allow to air dry 15 minutes.

**WARNING**

Make sure safety precautions are met for electrical, static, grounding when using eddy current equipment near aircraft fuel cells, oxygen systems, electrical systems, and stores (A1-F18AC-PCM-00).

14. **Equipment Settings/Standardization/Setup For Inboard Bushing Area.**

- a. Do general setup procedure, including initial equipment settings (WP008 00).

**WARNING**

Couplant may cause eye irritation. Avoid contact with eyes. Wash thoroughly after handling.

**NOTE**

Equipment differences may require use of alternate REP. RATE, DAMP., GAIN, and FINE SWEEP DELAY and SWEEP RANGE. After completion of general setup, initial pulse should be located at 0 on CRT horizontal baseline. See figure 4, CRT 1.

- b. Apply couplant to reference standard calibration points P-1 and P-2, see figure 4.

**NOTE**

When standardizing equipment, it will be required to maximize amplitude of responses received from reference notches by making slight adjustments (fwd/aft, right/left) in search unit position.

- c. Position 52° search unit assembly on reference standard calibration point P-1 and maximize received response, adjusting GAIN as required to keep maximum amplitude between 80 and 90 percent CRT height.

- d. Adjust FINE SWEEP RANGE to locate received response at 5 on horizontal baseline, see figure 4, CRT 2.

- e. Reposition search unit assembly on reference standard calibration point P-2 and maximize received response.

**NOTE**

GAIN may be adjusted by changing FINE GAIN, COARSE GAIN, or by toggling ATTENUATORS.

- f. Adjust GAIN to make amplitude of received response at 90 percent CRT height, see figure 4, CRT 3.

- g. Add 6 dB GAIN for scanning. Response should be greater than 100 percent CRT height.

15. **Inspection Procedure For Inboard Bushing Area.** Inspect area under inboard bushing as below:

- a. Apply couplant to surface of inspection area, scan area in figure 5.

- b. Position 52° search unit assembly in scan area and scan in direction shown in figure 5.

- c. After each scan, index 0.125 inch in direction shown.

- d. Using aircraft marking pencil, mark approximate location of responses from flaws under bushing that are between 5 and 10 on horizontal baseline and exceed 40 percent CRT height. See figure 4, CRT 4.

- e. Record marked areas of step d above.

f. Add 6 dB GAIN for scanning. Response should be greater than 100 percent CRT height.

g. Do paragraphs 20. and 21.

#### 16. ULTRASONIC METHOD USING MXU-715/E ULTRASONIC FLAW DETECTOR.

### Support Equipment Required

Part Number or Type Designation	Nomenclature
1642AS100-1	Ultrasonic Flaw Detector, MXU- 715/E, Magnaflux
57A2271 or EQUIVALENT	Microdot to BNC Connecting Cable
Fabricate, Figure 3	52°, 2.44 Radius, Horizontal Spindle Ultrasonic Inspection Wedge
224-580	K.B. Aerotech, Shear Wave, 0.250 Dia., 5.0 MHz, Removable Wedge Search Unit

### Materials Required

Specification or Part Number	Nomenclature
ULTRAGEL II M83953-1 or -2	Ultrasonic Couplant Pencil, Aircraft Marking
020X413	Cleaning Compound
CCCC46TY1CL4	Cloth, Cleaning

### WARNING

Cleaning compound is flammable liquid and vapor. May cause allergic respiratory and skin reaction. May cause eye, skin and respiratory irritation. Keep away from heat, sparks, and flame. Do not breathe dust (vapor, mist, gas). Use only with adequate ventilation. Keep container closed. Avoid contact with eyes, skin and clothing. Wash thoroughly after handling.

17. **Preparation of Part.** Clean inspection area(s) of contamination or foreign material using cleaning cloth moistened with cleaning compound. Allow to air dry 15 minutes.

### WARNING

Make sure safety precautions are met for electrical, static, grounding when using eddy current equipment near aircraft fuel cells, oxygen systems, electrical systems, and stores (A1-F18AC-PCM-00)

#### 18. Equipment Settings/Standardization/Setup For Inboard Bushing Area.

a. Do general setup procedure, including initial equipment settings (WP008 09).

### WARNING

Couplant may cause eye irritation. Avoid contact with eyes. Wash thoroughly after handling.

### NOTE

Equipment differences may require use of alternate REP. RATE, DAMP., GAIN, and HORIZONTAL SWEEP DELAY and LENGTH. Following completion of general setup, initial pulse should be located at 0 on CRT horizontal baseline. See figure 4, CRT 1.

b. Apply couplant to reference standard calibration points P-1 and P-2, see figure 4.

**NOTE**

When standardizing equipment, it will be required to maximize amplitude of responses received from reference notches by making slight adjustments (fwd/aft, right/left) in search unit position.

c. Position 52° search unit assembly on reference standard calibration point P-1 and maximize received response, adjusting GAIN as required to keep maximum amplitude between 80 and 90 percent CRT height.

d. Adjust HORIZONTAL SWEEP COARSE LENGTH to locate received response at 5 on horizontal baseline, see figure 4, CRT 2.

e. Reposition search unit assembly on reference standard calibration point P-2 and maximize received response.

f. Adjust GAIN to make amplitude of received response at 90 percent CRT height, see figure 4, CRT 3.

g. Add 6 dB GAIN for scanning. Response should be greater than 100 percent CRT height.

**19. Inspection Procedure For Inboard Bushing**

**Area.** Inspect area under inboard bushing as below:

**WARNING**

Couplant may cause eye irritation. Avoid contact with eyes. Wash thoroughly after handling.

a. Apply couplant to surface of inspection area, scan area in figure 5.

b. Position 52° search unit assembly in scan area and scan in direction shown in figure 5.

c. After each scan, index 0.125 inch in direction shown.

d. Using aircraft marking pencil, mark approximate location of responses from flaws under bushing that are between 5 and 10 on horizontal baseline and exceed 40 percent CRT height. See figure 4, CRT 4.

e. Record marked areas of step d above.

**20. POST INSPECTION CLEANING AND CORROSION CONTROL.****WARNING**

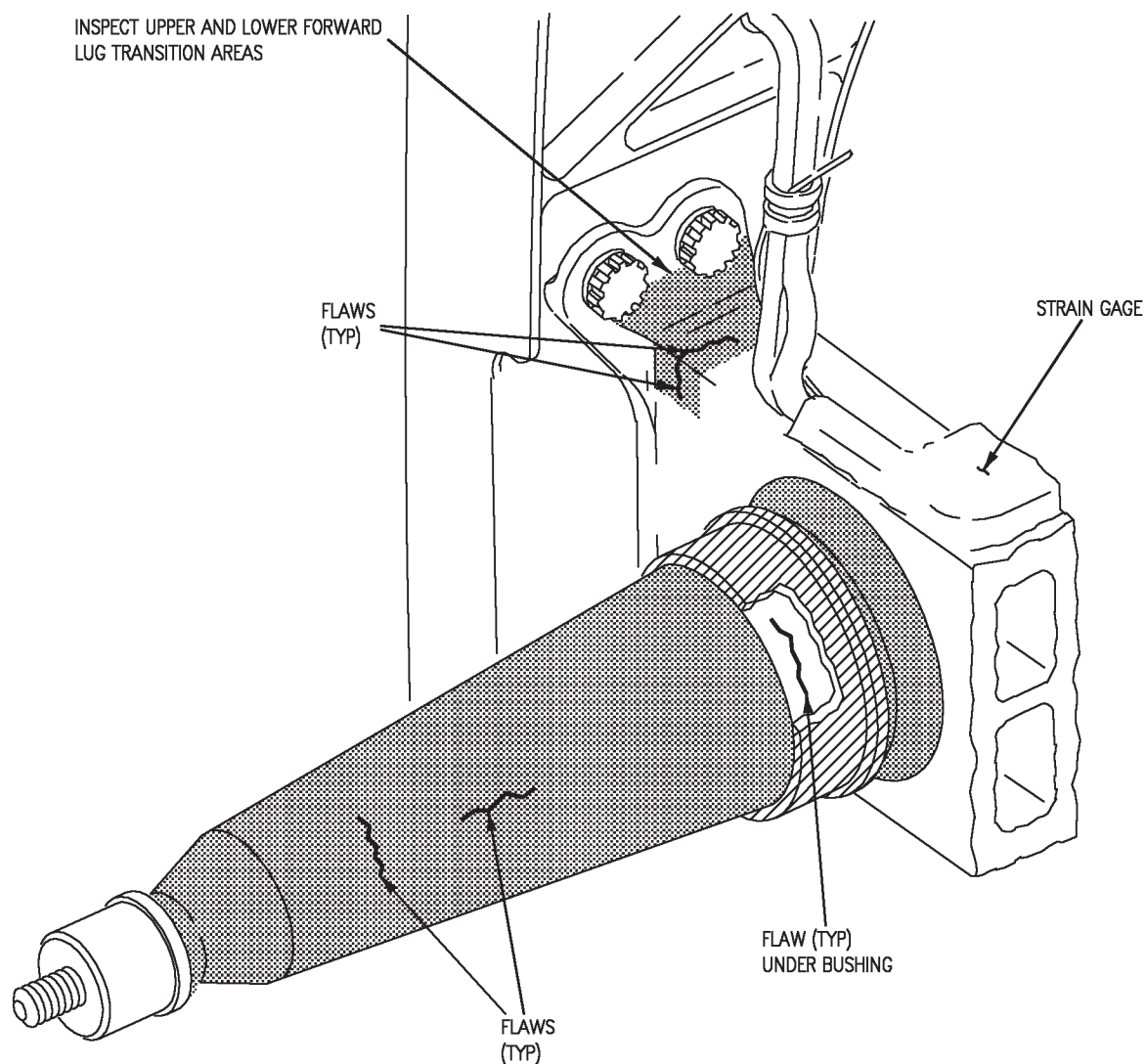
Cleaning compound is flammable liquid and vapor. May cause allergic respiratory and skin reaction. May cause eye, skin and respiratory irritation. Keep away from heat, sparks, and flame. Do not breathe dust (vapor, mist, gas). Use only with adequate ventilation. Keep container closed. Avoid contact with eyes, skin and clothing. Wash thoroughly after handling.

a. Clean inspection material from inspection area using cleaning cloth moistened with cleaning compound. Allow surface to air dry 15 minutes.

**21. SYSTEM SECURING.**

a. Install horizontal stabilator (A1-F18AC-570-300, WP021 00).

b. Install doors 72 and 73, left and right, (A1-F18AC-LMM-010).



LEFT SHOWN  
RIGHT OPPOSITE

## LEGEND



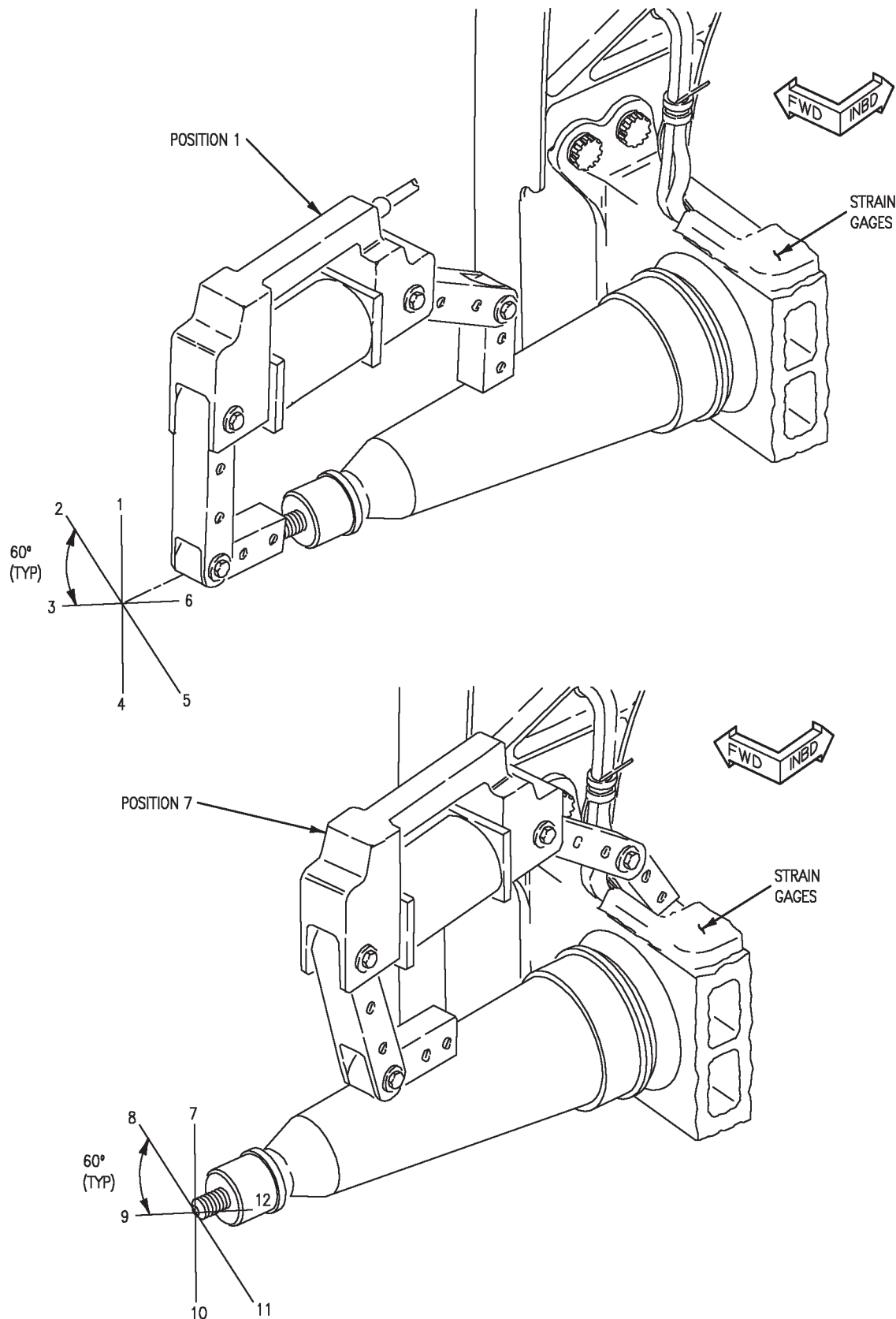
MAGNETIC PARTICLE INSPECTION AREA.



ULTRASONIC INSPECTION AREA.

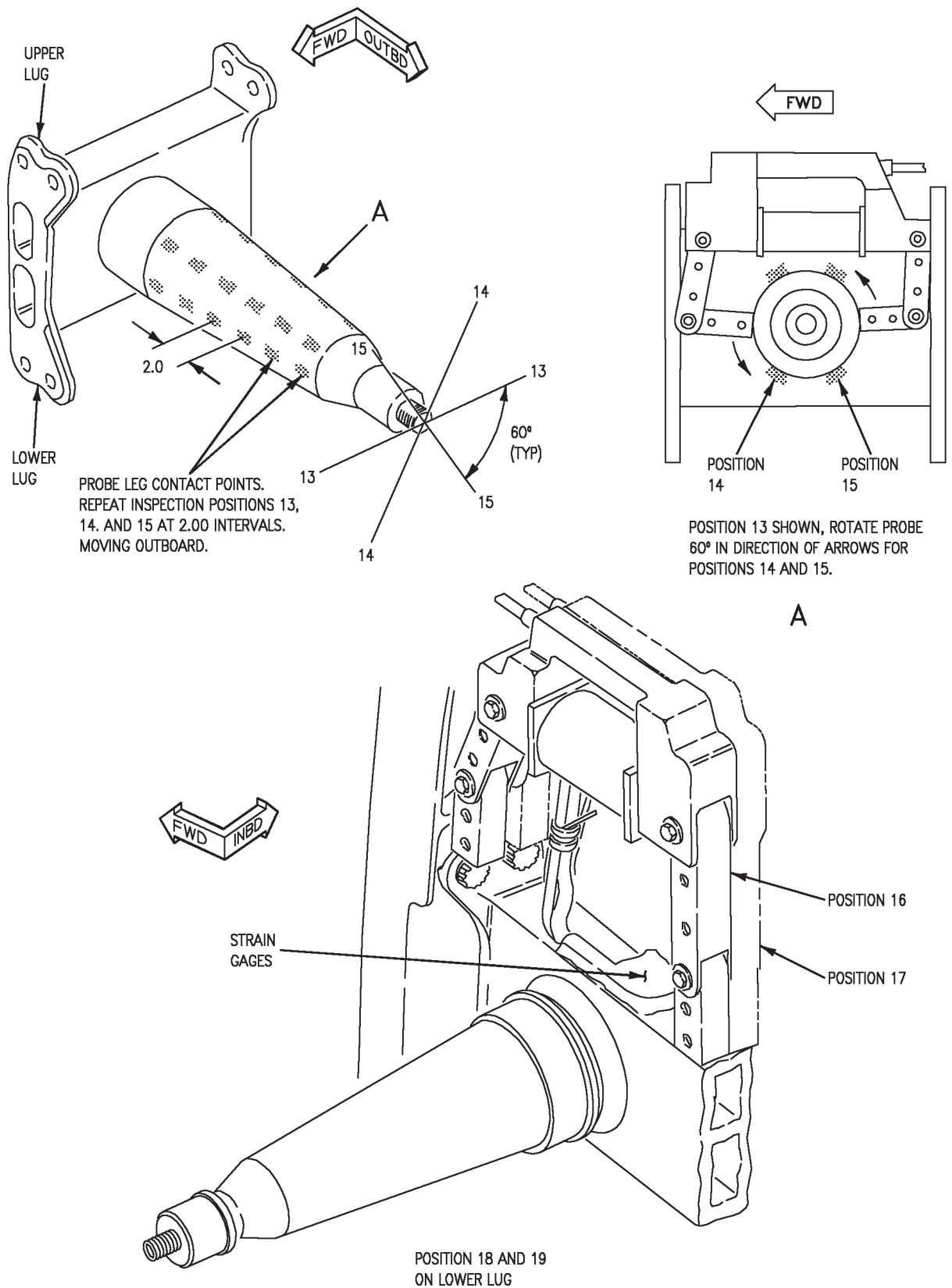
**Figure 1. Horizontal Stabilator Spindle Inspection Areas and Typical Flaws**



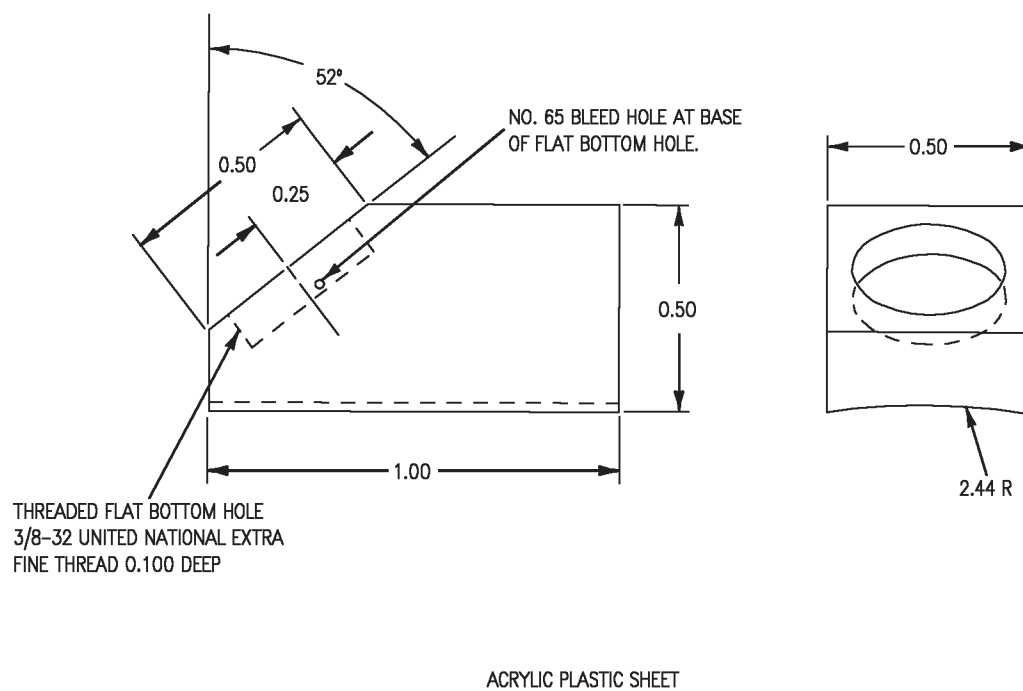


**Figure 2. Magnetic Particle Inspection Positions (Sheet 1)**

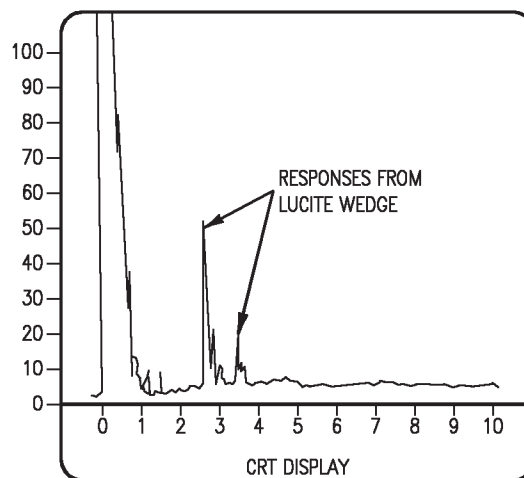
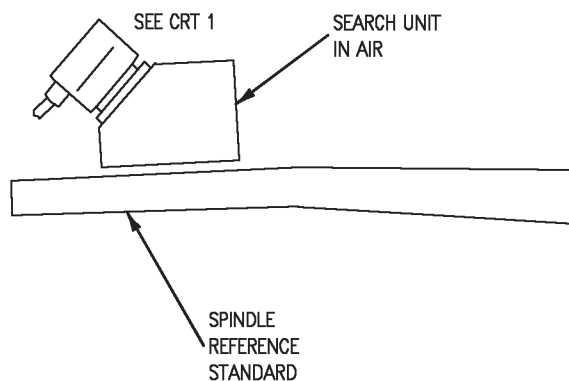




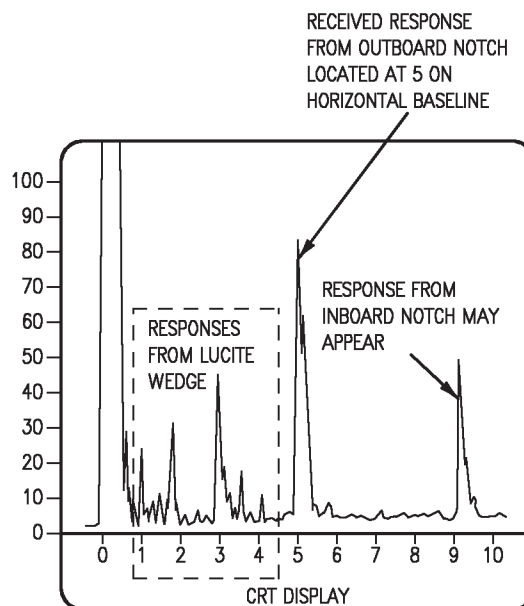
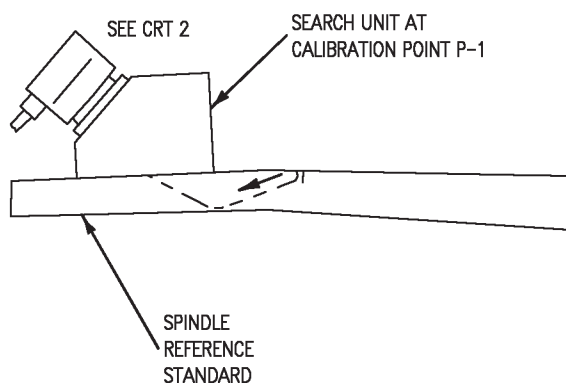
**Figure 2. Magnetic Particle Inspection Positions (Sheet 2)**



**Figure 3. Horizontal Stabilator Spindle Ultrasonic Inspection Wedge**

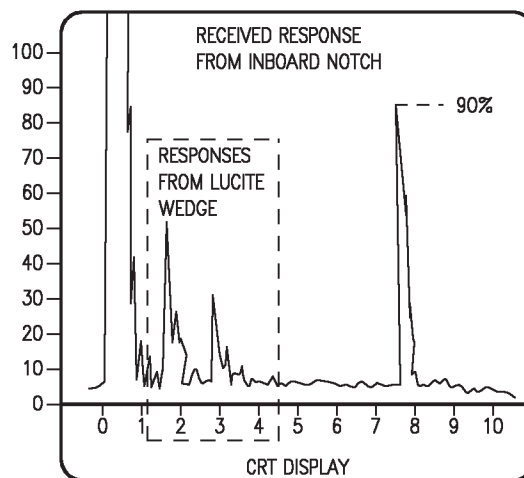
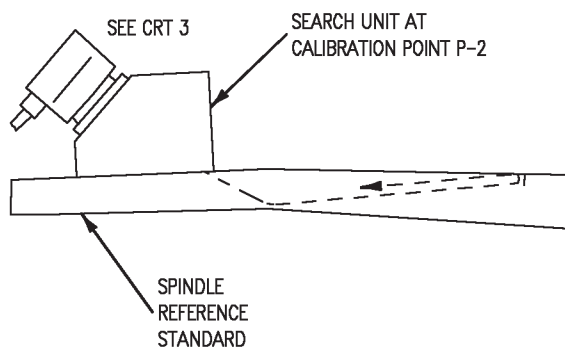


CRT 1

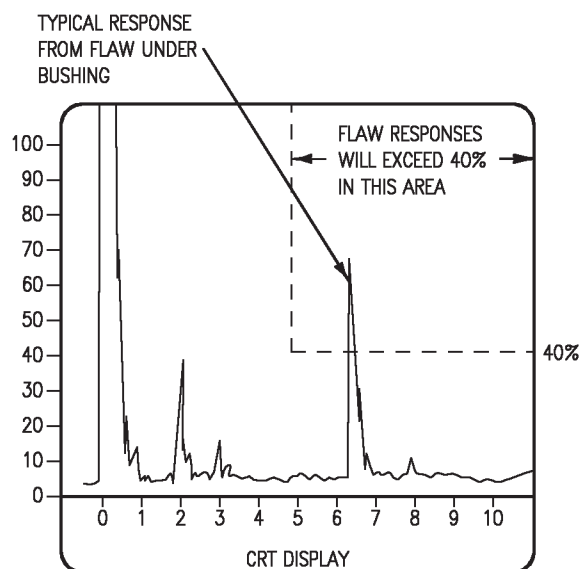
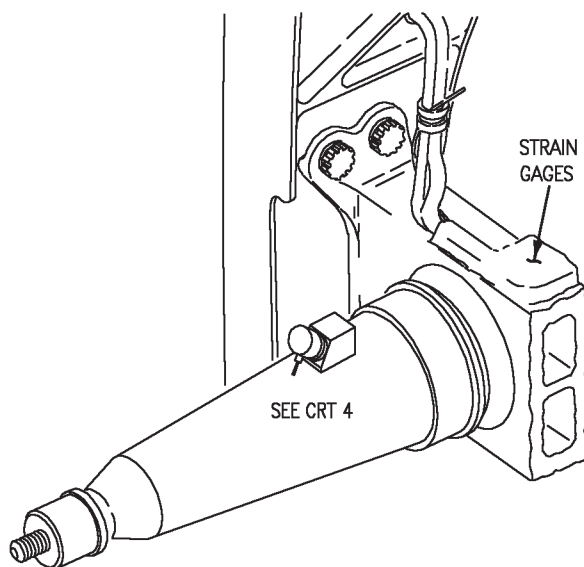


CRT 2

Figure 4. Horizontal Stabilator Spindle Ultrasonic Inspection Responses (Sheet 1)

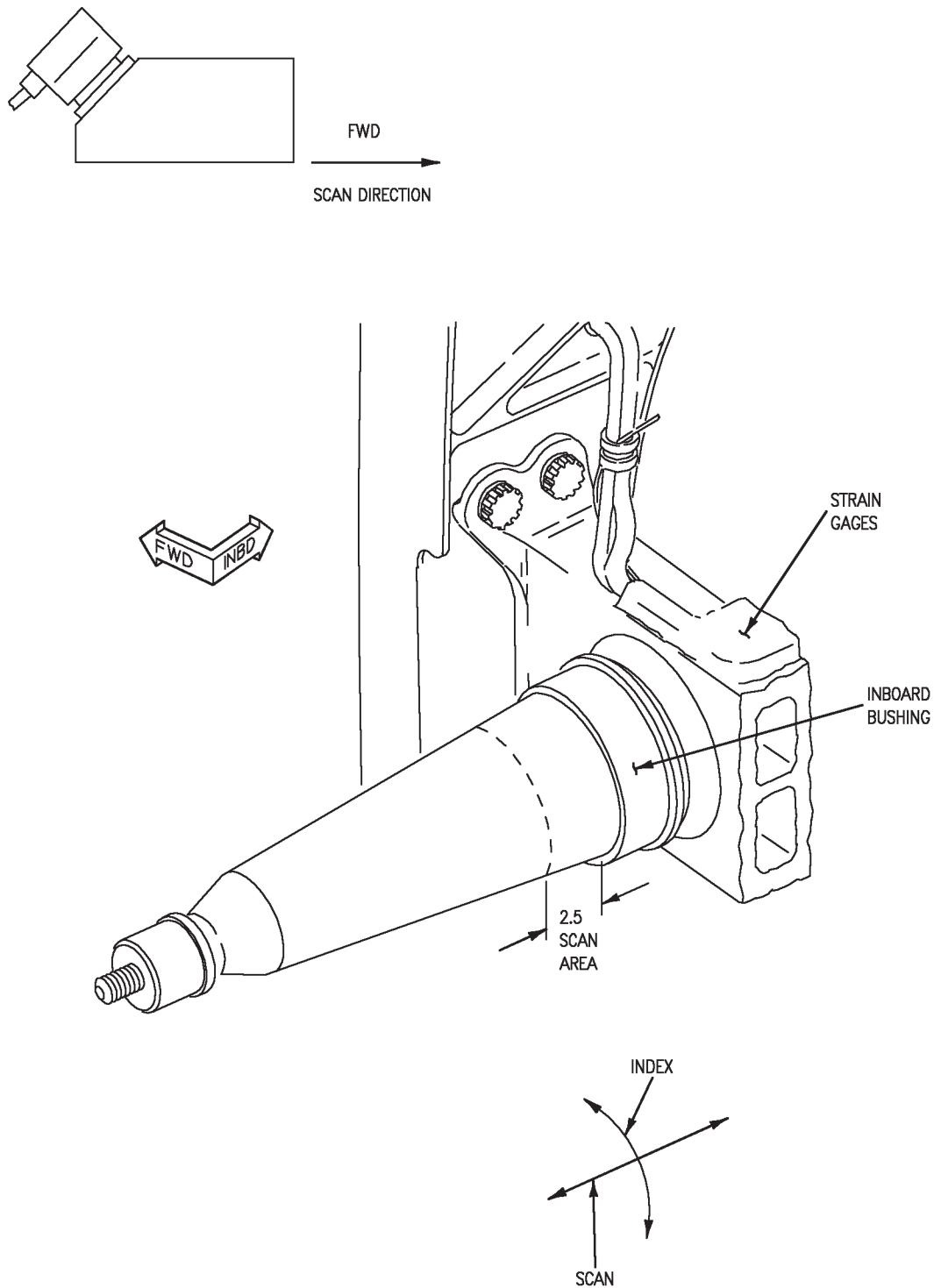


CRT 3



CRT 4

Figure 4. Horizontal Stabilator Spindle Ultrasonic Inspection Responses (Sheet 2)



**Figure 5. Ultrasonic Inspection Scan Area and Scan Directions**



## INTERMEDIATE MAINTENANCE

## NONDESTRUCTIVE INSPECTION

## HORIZONTAL STABILATOR STRUCTURAL SUPPORT

## FATIGUE CRACKS

## PART NO. 74A331401

## Reference Material

Naval Aviation Maintenance Program .....	OPNAVINST 4790.2
Line Maintenance Access Doors .....	A1-F18AC-LMM-010
Integrated Flight Controls .....	A1-F18AC-570-300
Stabilator Servocylinder (84A-S015 or 84A-T016) .....	WP022 00
Aircraft Corrosion Control .....	A1-F18AC-SRM-500
Stripping .....	WP007 00
Finish System .....	WP012 00
Nondestructive Inspection .....	A1-F18AC-SRM-300
Penetrant Method .....	WP004 00
Eddy Current Surface Inspection of Aluminum Alloys .....	WP007 00
Eddy Current Hole Inspection of Aluminum Alloys .....	WP007 01
Structure Repair, Aft Fuselage .....	A1-F18AC-SRM-240
Aft Fuselage Structure .....	WP007 00

## Alphabetical Index

Subject	Page No.
Horizontal Stabilator Structural Support .....	1
Defects .....	2
Eddy Current Method .....	3
Penetrant Method .....	2
Post Inspection Cleaning and Corrosion Control .....	4
Primary Inspection Methods .....	2
System Securing .....	5

## Record of Applicable Technical Directives

None

1. HORIZONTAL STABILATOR  
STRUCTURAL SUPPORT.

aluminum alloy forging. Support is chemical conversion coated and ion vapor deposition (IVD), aluminum, coated. Surface finish is epoxy primer.

2. Horizontal stabilator structural support (support), see figure 1, is machined 7050

3. **DEFECTS.** Inspect support for fatigue cracks, see figure 1.

4. **PRIMARY INSPECTION METHODS.** Primary inspection methods are fluorescent penetrant and eddy current.

5. **Personnel Qualifications.** Personnel doing this nondestructive inspection should be qualified and certified to do liquid penetrant and eddy current inspections per OPNAVINST 4790.2 SERIES, NDI Technicians, NEC 7225/MOS 6044..

6. **PENETRANT METHOD.**

7. **Preparation of Aircraft.** No special preparation required.

8. **Access.**

a. Have door 71 removed (A1-F18AC-LMM-010).

b. Have horizontal stabilator servocylinder removed (A1-F18AC-570-300, WP022 00).

### Support Equipment Required

#### NOTE

Alternate item type designations or part numbers are listed in parentheses.

Part Number or Type Designation	Nomenclature
ZA43 (TT10) (XMA101)	Portable Fluorescent Penetrant Inspection Kit
M-16	Black Light
J-221	Ultraviolet Meter
—	14 X Magnifier

### Materials Required

#### NOTE

Alternate item specifications or part numbers are shown indented.

Specification or Part Number	Nomenclature
P-D-680, TYPE 2 D 1153	Dry Cleaning Solvent Methyl Isobutyl Ketone
A-A-883, TYPE 1	Pressure Sensitive Tape, Masking Tape
MIL-P-83953-2, TYPE 1, CLASS A or B, RED or BLACK	Aircraft Marking Pencil

#### 9. Preparation of Part.

a. Have finish system removed from inspection areas (A1-F18AC-SRM-500, WP007 00).

(1) For 161353 THRU 161761; outer surface of steel plates bonded to inboard servocylinder attach lug fittings, see figure 1.

(2) For 161924 AND UP; inner and outer surface of titanium inboard servocylinder attach lug fitting.

#### WARNING

Dry cleaning solvent and methyl isobutyl ketone are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

b. Clean inspection areas with solvent moistened cloth to make sure inspection area is free of contamination or foreign material.

#### 10. Inspection Procedure.

a. Do type I, method C fluorescent penetrant inspection (WP004 00).



b. Clean inspection areas with solvent moistened cloth to make sure inspection area is free of contamination or foreign material.

#### 11. Inspection Procedure.

a. Do type I, method C fluorescent penetrant inspection (WP004 00).

b. After removing excess penetrant, spray thin film of developer on inspection surface.

c. Use black light and 14 X magnifier to view inspection area for cracks.

d. Evaluate indications, mark location of any defect with aircraft marking pencil and record.

#### 12. EDDY CURRENT METHOD.

13. **Preparation of Aircraft.** No special preparation required.

14. **Access.** Same as penetrant method except as below:

a. Have the two fasteners between inner and outer attach lug fittings removed, see figure 1.

b. Have bearing removed from outer attach lug fitting, see figure 1 and (A1-F18AC-SRM-240, WP007 00).

### Support Equipment Required

#### NOTE

Alternate item type designations or part numbers are listed in parentheses.

Part Number or Type Designation	Nomenclature
ED520	Eddy Current Flaw Detector, Magnatest
S20204	EDM Notch Reference Standard, Aluminum
1RR90F-6-1/2	Right Angle Surface Probe
64001-172	Bolt Hole Probe
64101.1/4	Bolt Hole Probe, 0.250 Dia., Ideal Specialty

### Support Equipment Required (Continued)

#### NOTE

Alternate item type designations or part numbers are listed in parentheses.

Part Number or Type Designation	Nomenclature
Fabricate, Figure 2	Servocylinder Outer Attach Lug Fitting Eddy Current Probe Guide
VM99BM	Microdot to BNC Connecting Cable, Eddy Current

### Materials Required

#### NOTE

Alternate item type designations or part numbers are shown indented.

Specification or Part Number	Nomenclature
P-D-680, TYPE 2 D 1153	Dry Cleaning Solvent Methyl Isobutyl Ketone
MIL-P-83953-2, TYPE 1, CLASS A or B, RED or BLACK	Aircraft Marking Pencil
MIL-C-87962, TYPE I	Cleaning Cloth

#### 15. Preparation of Part.

a. Have sealant removed from all figure 1 eddy current inspection areas with a sealant scraper.

**WARNING**

Dry cleaning solvent and methyl isobutyl ketone are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

b. Clean support with solvent moistened cloth to make inspection areas are free of contamination or foreign material.

**16. Equipment Settings/Standardization/Setup.**

a. For eddy current surface inspection areas, see figure 1, do ED520 Flaw Detector Setup (WP007 00) using the 1RR90F-6-1/2 right angle surface probe.

b. For eddy current inspection of two fastener holes between inner and outer attach lug fitting, see figure 1, do ED520 Flaw Detector Setup (WP007 01) using 64001-172 bolt hole probe.

c. For eddy current inspection of outer lug fitting hole do ED520 Flaw Detector Setup (007 01) except as below:

(1) Use 64101.1/4 bolt hole probe.

(2) Standardize using 1/4 inch diameter hole with 0.060 inch notch of the notch aluminum, reference standard.

(3) Insert eddy current probe into probe guide, see figure 2, directing probe coil outward with approximately 0.050 from coil center to bottom seat edge, see figure 3.

**17. Inspection Procedure.****NOTE**

As probe is moved along or near radius, edge of part, or fastener, meter needle may move gradually up or down scale. If required, BALANCE may be used to return meter needle to 250 microamperes and scan parallel to edge or radius.

a. For eddy current surface inspection areas do Inspection Procedure (WP007 00) and as below:

(1) Scan perpendicular to suspected crack direction and as shown in figure 1.

(2) Mark area(s) with aircraft marking pencil where repeatable, sharp down scale deflection of meter needle indicates crack.

b. For eddy current inspection of two fastener holes between inner and outer attach lug fittings, do ED520 Inspection Procedure (WP007 01) using 64001-172 bolt hole probe.

c. For eddy current inspection of outboard attach lug hole do Inspection Procedure (WP007 01) except as below:

(1) Position 64101.1/4 bolt hole probe and probe guide in outboard attach lug fitting hole, see figure 3.

(2) Use BALANCE to set meter needle to 250 microamperes.

(3) Rotate probe in probe guide until maximum meter reading is received and use BALANCE to return meter needle to 250 microamperes.

(4) Slowly rotate probe guide at least one full revolution to scan hole surface. Make sure probe is firmly secured in probe guide and does not move during scanning.

(5) Index probe by extending distance of probe coil center to bottom seat edge 0.050 inch each scan.

(6) Repeat substeps (1) through (5) until all surface of outer attach lug hole has been inspected.

d. Mark all areas with aircraft marking pencil where repeatable, sharp down scale deflection of meter needle indicates a crack.

e. Read all defects.

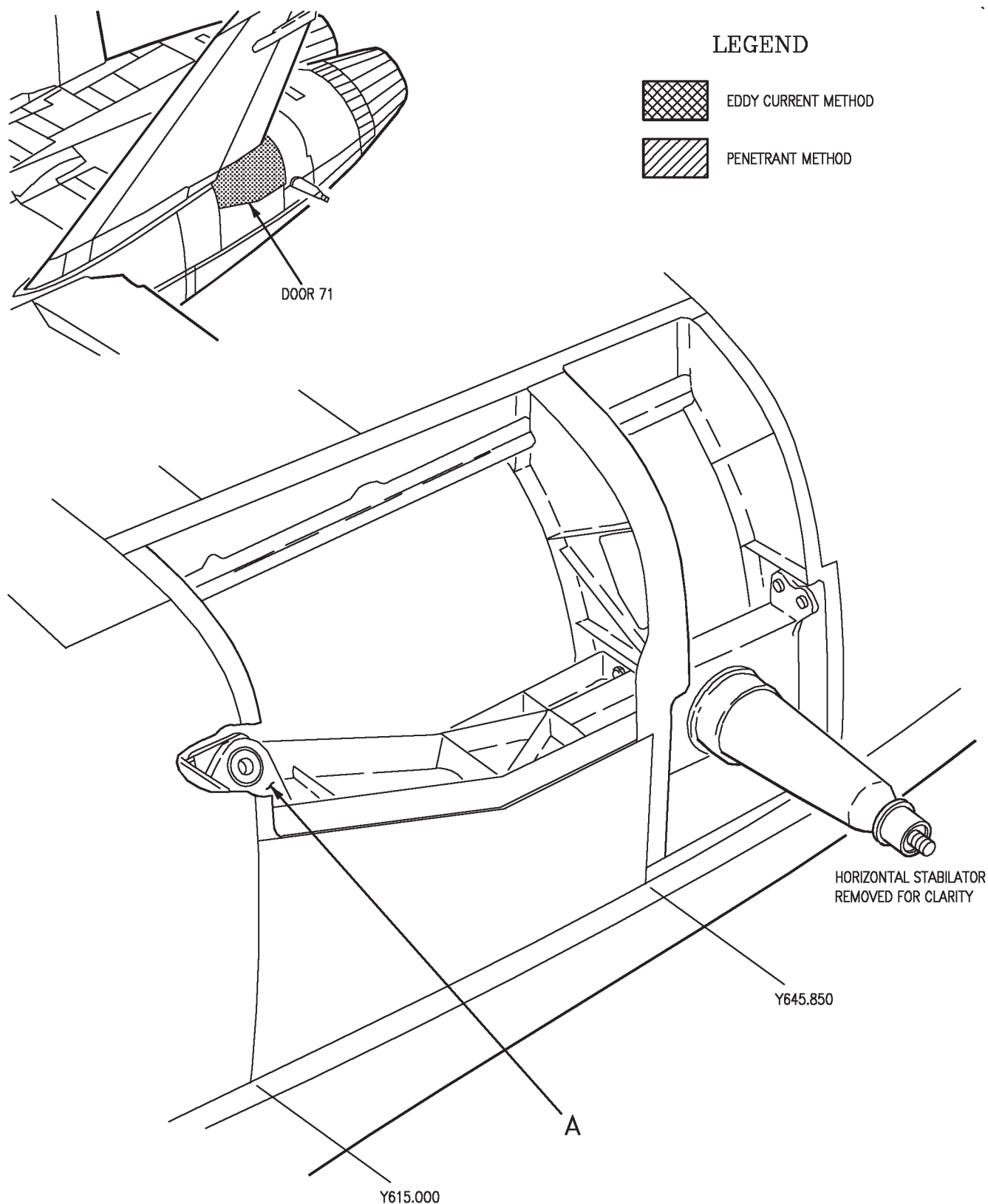
**18. POST INSPECTION CLEANING AND CORROSION CONTROL.**

a. Clean inspection marks and materials from inspection areas with solvent moistened cloth.

b. Have inspection areas refinished (A1-F18AC-SRM-500, WP012 00).

## 19. SYSTEM SECURING.

- a. Have bearing reinstalled in outer attach lug fitting (A1-F18AC-SRM-240, WP007 00).
- b. Have horizontal stabilator servocylinder reinstalled (A1-F18AC-570-300, WP022 00).
- c. Have door 71 reinstalled (A1-F18AC-LMM-010).



161353 THROUGH 161761

18AC-SRM-310-(3B-1)01-SCAN

**Figure 1. Horizontal Stabilator Structural Support Inspection Areas, Typical Flaws, and Scan Directions (Sheet 1)**

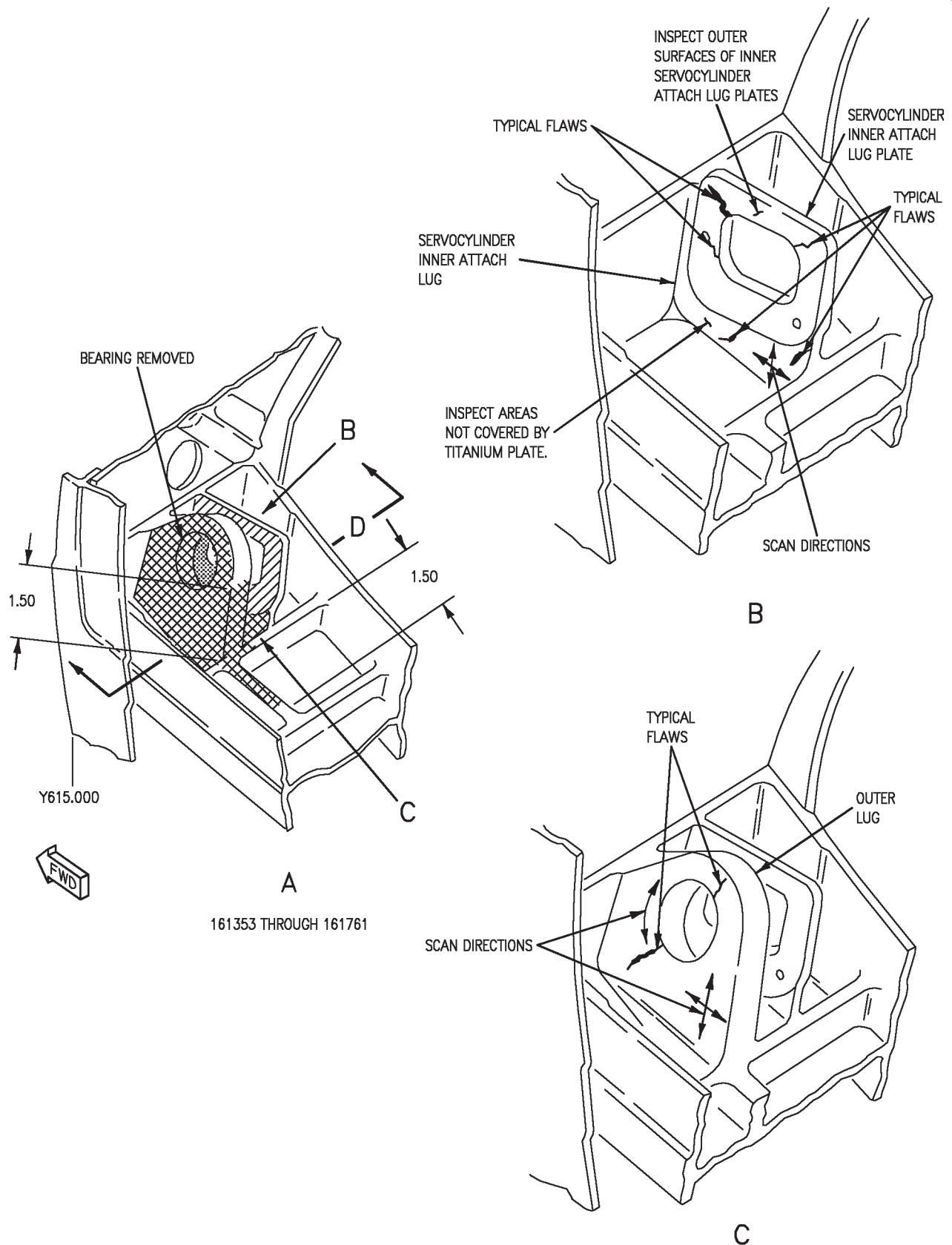
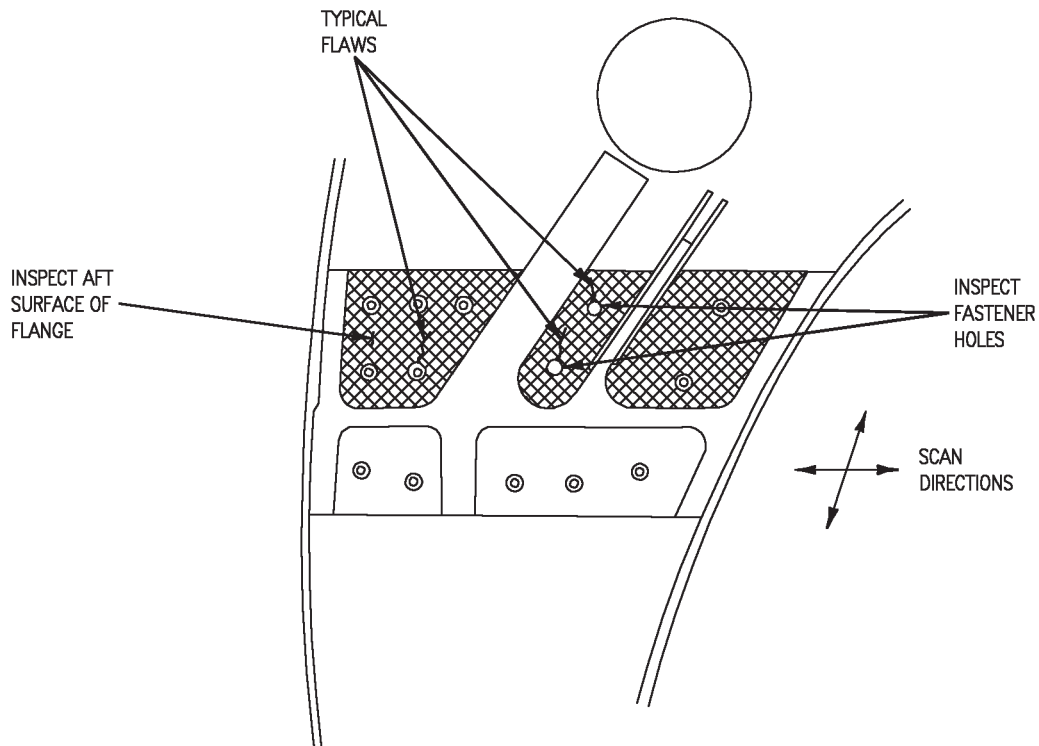


Figure 1. Horizontal Stabilator Structural Support Inspection Areas, Typical Flaws, and Scan Directions (Sheet 2)



D

161353 THROUGH 161761

**Figure 1. Horizontal Stabilator Structural Support Inspection Areas, Typical Flaws, and Scan Directions (Sheet 3)**

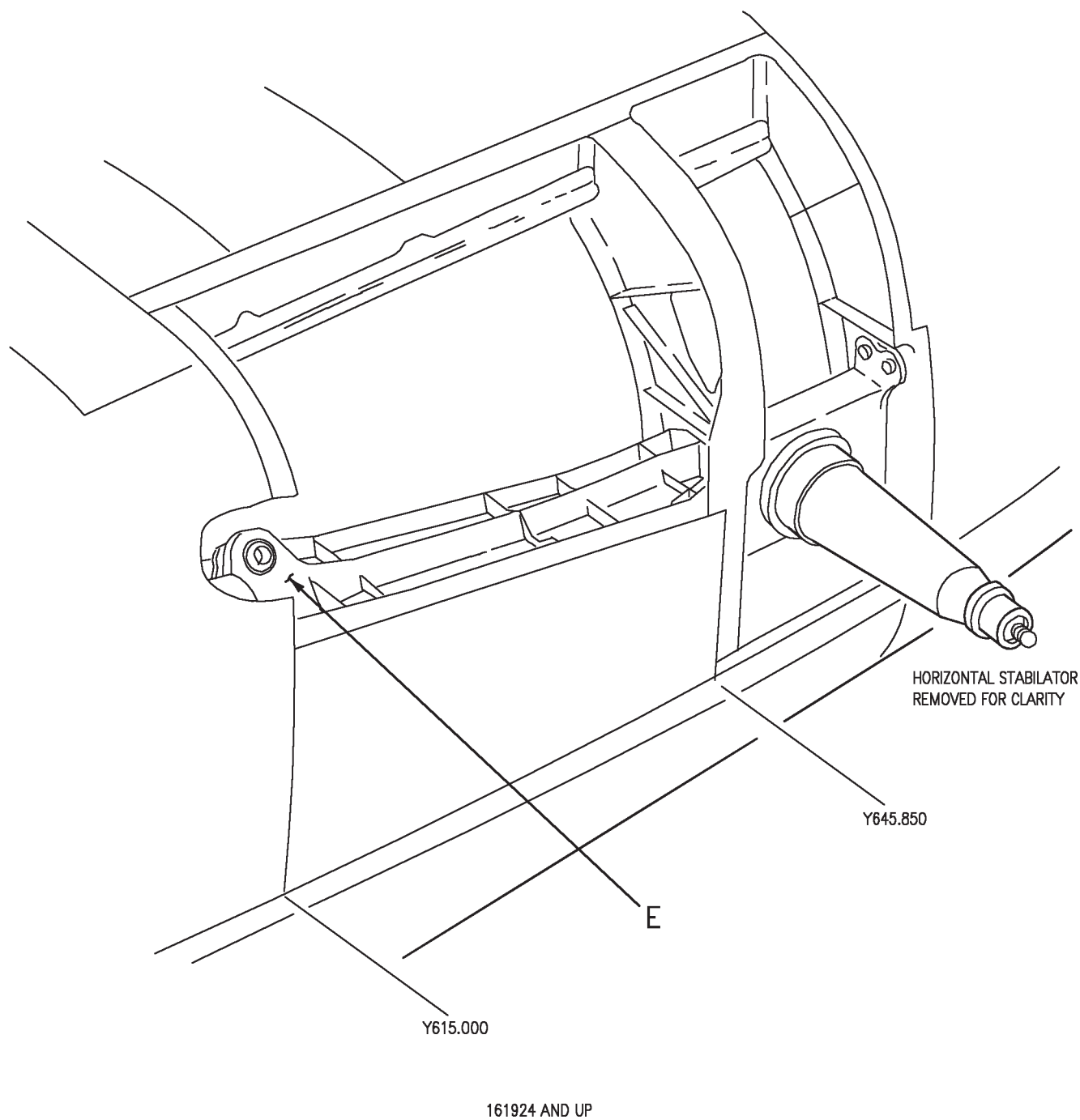


Figure 1. Horizontal Stabilator Structural Support Inspection Areas,  
Typical Flaws, and Scan Directions (Sheet 4)

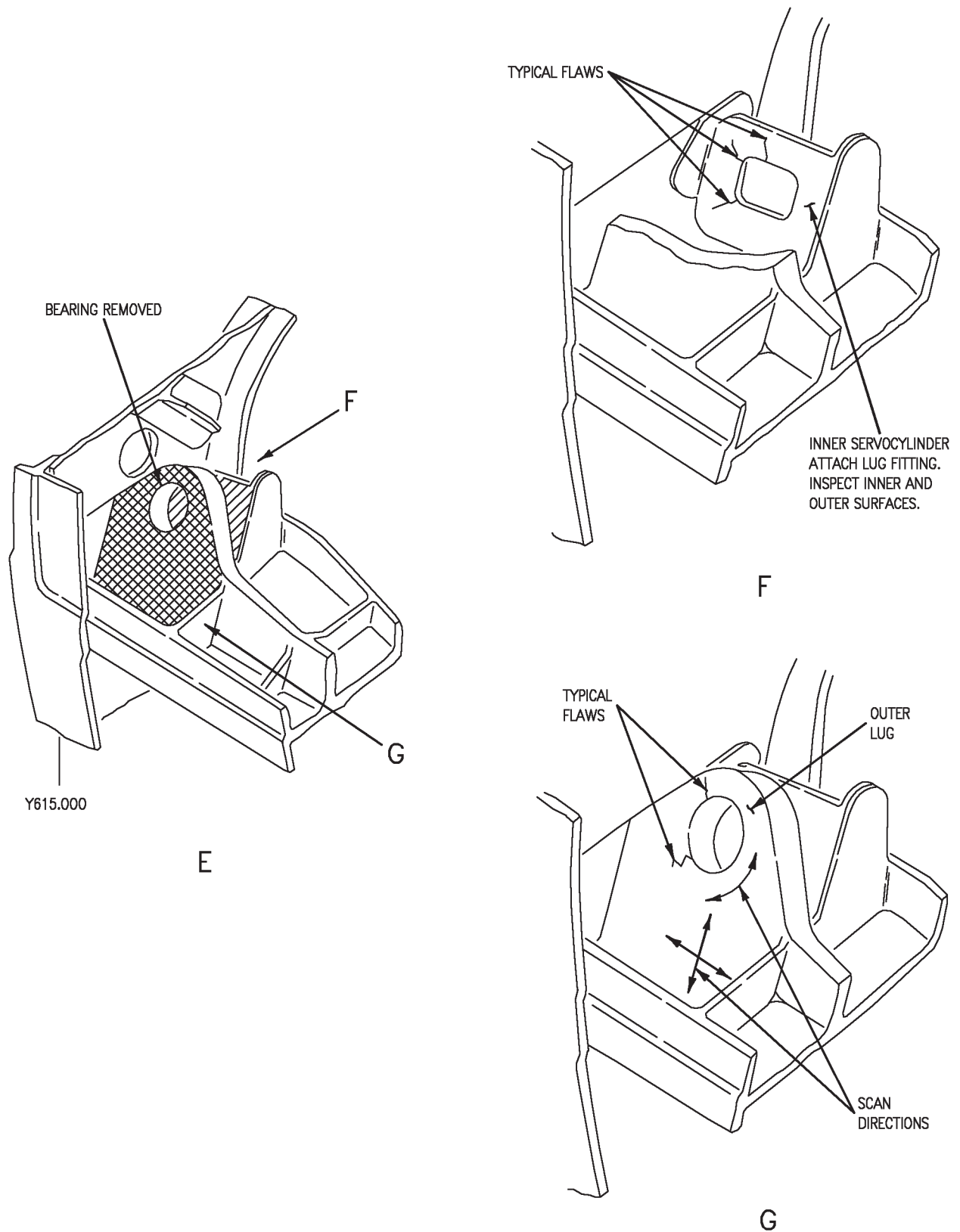


Figure 1. Horizontal Stabilator Structural Support Inspection Areas, Typical Flaws, and Scan Directions (Sheet 5)



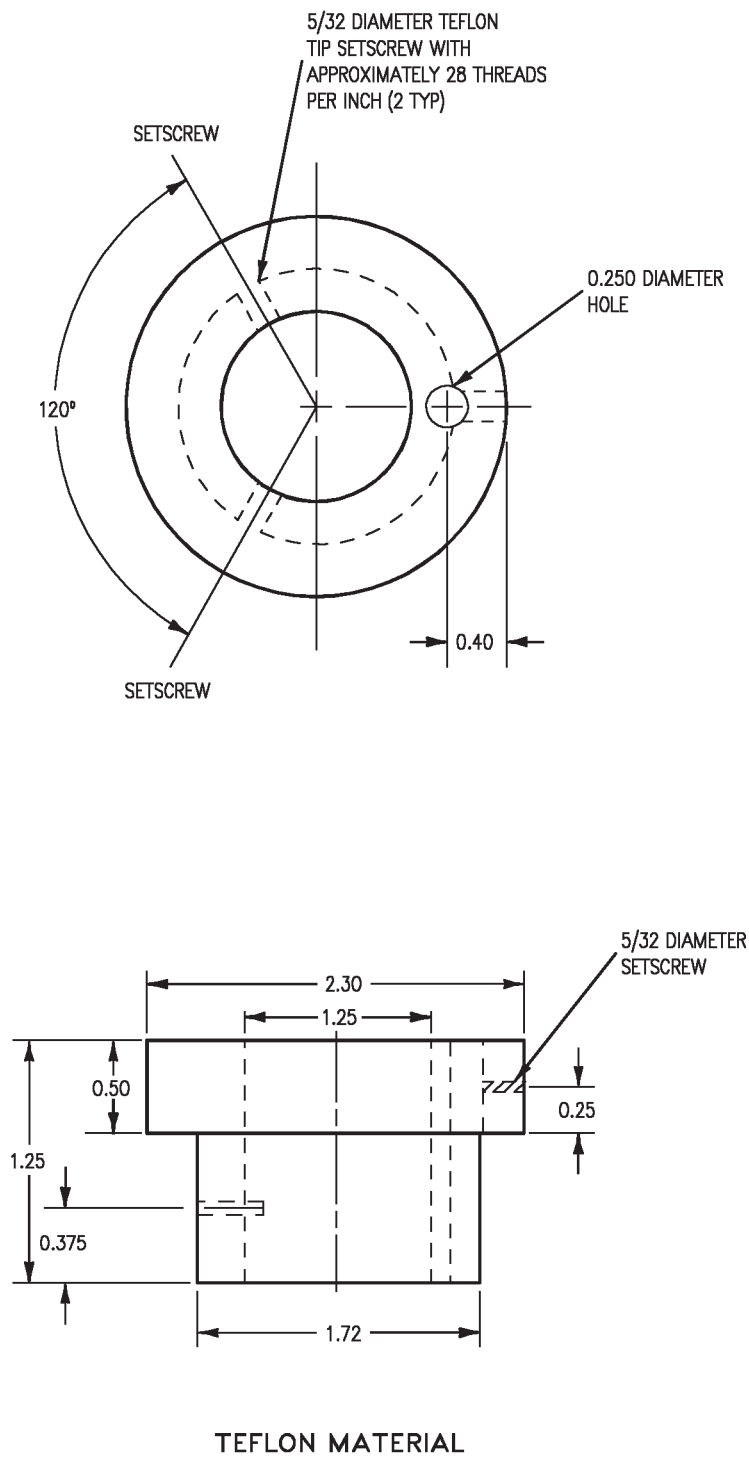


Figure 2. Servocylinder Outer Attach Lug Fitting Eddy Current Probe Guide

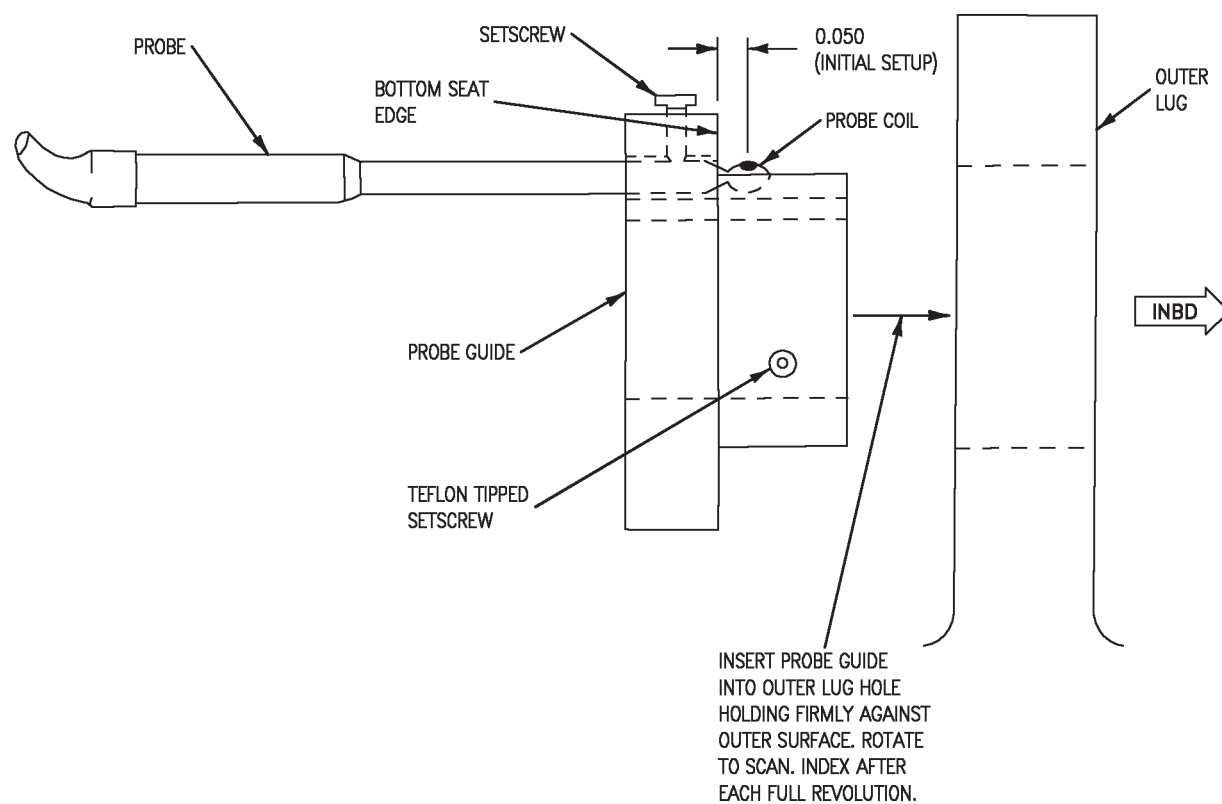


Figure 3. Eddy Current Probe and Probe Guide Adjustment, Setup, and Inspection

## INTERMEDIATE MAINTENANCE

## NONDESTRUCTIVE INSPECTION

## ENGINE; INBOARD THRUST MOUNT

## FATIGUE CRACKS

## PART NO. 74A501200

This WP supersedes WP04500, dated 15 December 1992.

## Reference Material

Line Maintenance Access Doors.....	A1-F18AC-LMM-010
Power Plant and Related Systems .....	A1-F18AC-270-300
Removal and Installation - Engine (3MAS551 or 3MAT552).....	WP003 00
Aircraft Corrosion Control.....	A1-F18AC-SRM-500
Stripping.....	WP007 00
Engine Supports Finish System .....	WP045 00
Aircraft Weapons System Cleaning and Corrosion Control .....	NAVAIR 01-1A-509
Nondestructive Inspection.....	A1-F18AC-SRM-300
Magnetic Particle Method.....	WP006 00
Penetrant Method.....	WP004 00
Nondestructive Inspection Methods .....	NAVAIR 01-1A-16
Naval Aviation Maintenance Program .....	OPNAVINST 4790.2

## Alphabetical Index

Subject	Page No.
Engine; Inboard Thrust Mount .....	1
Defects .....	2
Magnetic Particle Method .....	3
Penetrant Method.....	2
Post Inspection Cleaning and Corrosion Control.....	5
Primary Inspection Methods.....	2
Rework Inspection .....	5
System Securing.....	5

## Record of Applicable Technical Directives

None

## 1. ENGINE; INBOARD THRUST MOUNT.

ultimate strength of 200,000 PSI. Finish system is epoxy primer and polyurethane coatings.

2. Engine; inboard thrust mount (engine mount) is made of PH13-8MO, H1000, stainless steel with

3. **DEFECTS.** Inspect engine mount for fatigue cracks, see figure 1.

4. **PRIMARY INSPECTION METHODS.** Primary inspection methods are liquid penetrant and magnetic particle.

**NOTE**

Magnetic particle inspection correlation should be made only if engine mount will be reworked by metal removal. If engine mount is to be replaced because of flaw indications detected by penetrant inspection, do not do magnetic particle inspection.

5. **Personnel Qualifications.** Personnel doing these nondestructive inspections should be qualified and certified to do liquid penetrant and magnetic particle inspections per OPNAVINST 4790.2 SERIES, NDI Technicians, NEC 7225/MOS 6044.

6. **Preparation of Aircraft.** Have aircraft prepared for engine removal.

7. **Access.**

a. Have engine bay doors opened (A1-F18AC-LMM-010).

b. Have engine removed (A1-F18AC-270-300, WP003 00).

8. **PENETRANT METHOD.****Support Equipment Required****NOTE**

Alternate item type designations or part numbers are listed in parentheses.

Part Number or Type Designation	Nomenclature
XMA101	Portable Fluorescent Penetrant Inspection Kit
—	5 to 14 X Pocket Magnifier
M-16 (ZB-26)	Black Light

**Materials Required****NOTE**

Alternate item part numbers are shown indented.

Specification or Part Number	Nomenclature
PD680TY2 D 1153	Dry Cleaning Solvent Methyl Isobutyl Ketone
M83953-1 or -2	Pencil, Aircraft Marking
MILC87962TYPE1 MIL-I-25135, Developer	Cleaning Cloth Non-Aqueous Developer

9. **Preparation of Part.****CAUTION**

Make sure inspection areas are not mechanically worked with abrasive paper or files before initial penetrant inspection to avoid false indications.

a. Have finish system removed from inspection areas shown in figure 1 (NAVAIR 01-1A-509, NAVAIR 01-1A-16, and A1-F18AC-SRM-500, WP007 00).

**WARNING**

Dry cleaning solvent and methyl isobutyl ketone are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

b. Clean inspection areas of any contamination or foreign material using cleaning cloth moistened with dry cleaning solvent or methyl isobutyl ketone.

10. **Penetrant Inspection.** Do initial penetrant inspection as listed below:

**CAUTION**

Penetrant inspection shall not be done at suspect crack indication area, after abrasive material removal such as: grinding, sanding, or polishing. Smearing of material will result and interpretation of crack indication will not be possible.

a. Do type 1, method C fluorescent penetrant inspection (WP004 00) to detect fatigue cracks in areas shown in figure 1.

b. Remove excess penetrant by hand wiping as below:

(1) After penetrant dwell time is complete, excess penetrant shall be removed by wiping with cleaning cloth.

**WARNING**

Dry cleaning solvent and methyl isobutyl ketone are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

**NOTE**

Fluorescent penetrant removal shall be done with aid of black light in shaded or darkened area.

(2) Remove background color using cleaning cloth moistened with dry cleaning solvent or methyl isobutyl ketone.

c. Spray thin film of developer on inspection areas.

d. Use black light and magnifier, if required, to view inspection areas for cracks.

e. Mark defect end points with sharp pointed aircraft marking pencil.

f. Record defects on sketch similar to figure 2.

11. **MAGNETIC PARTICLE METHOD.** Correlate penetrant method flaw indications with below magnetic particle method inspection.

**NOTE**

Magnetic particle inspection correlation should be made only if engine mount will be reworked by metal removal. If engine mount is to be replaced because of flaw indications detected by penetrant inspection, do not do magnetic particle inspection.

**Support Equipment Required****NOTE**

Alternate item type designations or part numbers are listed in parentheses.

Part Number or Type Designation	Nomenclature
DA200	Magnetic Inspection Probe
2480	Magnetic Particle Field Indicator
M-16 (ZB-26)	Black Light
—	5 to 14 X Pocket Magnifier

**Materials Required****NOTE**

Alternate item part numbers are shown indented.

Specification or Part Number	Nomenclature
PD680TY2 D 1153	Dry Cleaning Solvent Methyl Isobutyl Ketone
14AM	Magnetic Inspection Compound
A-A-883, TYPE 1 M83953-1 or -2	Pressure Sensitive Tape Pencil, Aircraft Marking

**Materials Required (Continued)****NOTE**

Alternate item part numbers are shown indented.

**Specification  
or Part Number****Nomenclature**

MILC87962TYPE1 Cleaning Cloth

**NOTE**

Make sure magnetic particle indications correlate closely with original penetrant indications and are not result of delta ferrite/retained austenite type stringers or material segregation.

a. Do residual magnetic particle inspection using hand held magnetic inspection probe (probe) with articulated legs (NAVAIR 01-1A-16) and the procedures below, to detect fatigue cracks in inspection areas shown in figure 1.

**WARNING**

Dry cleaning solvent and methyl isobutyl ketone are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

b. Clean inspection area with cleaning cloth moistened with dry cleaning solvent or methyl isobutyl ketone to remove inspection penetrant and other foreign materials.

c. Use black light to make sure inspection area is free of fluorescent materials.

**CAUTION**

Probe method of magnetization shall be used. Pass no current through part to avoid arc burns.

d. Before inspection with probe, make sure residual field in inspection area is less than two

small divisions of meter deflection on field indicator. Use probe with AC magnetization to reduce inspection area residual magnetization to a good level (WP006 00 and NAVAIR 01-1A-16).

e. Select DC and MAXIMUM current on probe.

f. Adjust probe articulating legs, as required.

g. Position probe legs against engine mount in applicable inspection position shown in figure 3.

h. Switch probe ON for 15 to 30 seconds.

i. Turn probe OFF and remove probe from inspection area.

**WARNING**

Magnetic inspection compound may cause eye and skin irritation. Avoid contact with eyes, skin and clothing. Wash thoroughly after handling.

j. Spray heavy coat of magnetic inspection compound (spray bath) on inspection area.

k. After spray bath has set on inspection area for 5 to 10 seconds or more, clean area using cleaning cloth moistened with dry cleaning solvent or methyl isobutyl ketone.

l. Test for minimum background with black light.

m. Spray light uniform thin film of spray bath on inspection area so there is light fluorescent background.

n. Use black light and magnifier, if required, to inspect radius for fatigue cracks.

o. Mark defect end points with sharp pointed aircraft marking pencil.

p. Record defects on sketch similar to figure 2. Make sure original magnetic particle flaw indication correlates with original penetrant indication. In some cases, magnetic particle indication may appear larger than penetrant indication.

q. After inspection and flaw documentation, demagnetize engine mount (WP006 00 and NAVAIR 01-1A-16).

## 12. REWORK INSPECTION.

a. Do magnetic particle inspection in all reworked and nearby areas per paragraph 11. Do steps 11.b. through 11.q. to make sure flaw indication has been removed during grinding/polishing operations or flaw is contained between stop drill hole locations.

b. Demagnetize engine mount (WP006 00 and NAVAIR 01-1A-16).

## 13. POST INSPECTION CLEANING AND CORROSION CONTROL.

### WARNING

Dry cleaning solvent and methyl isobutyl ketone are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

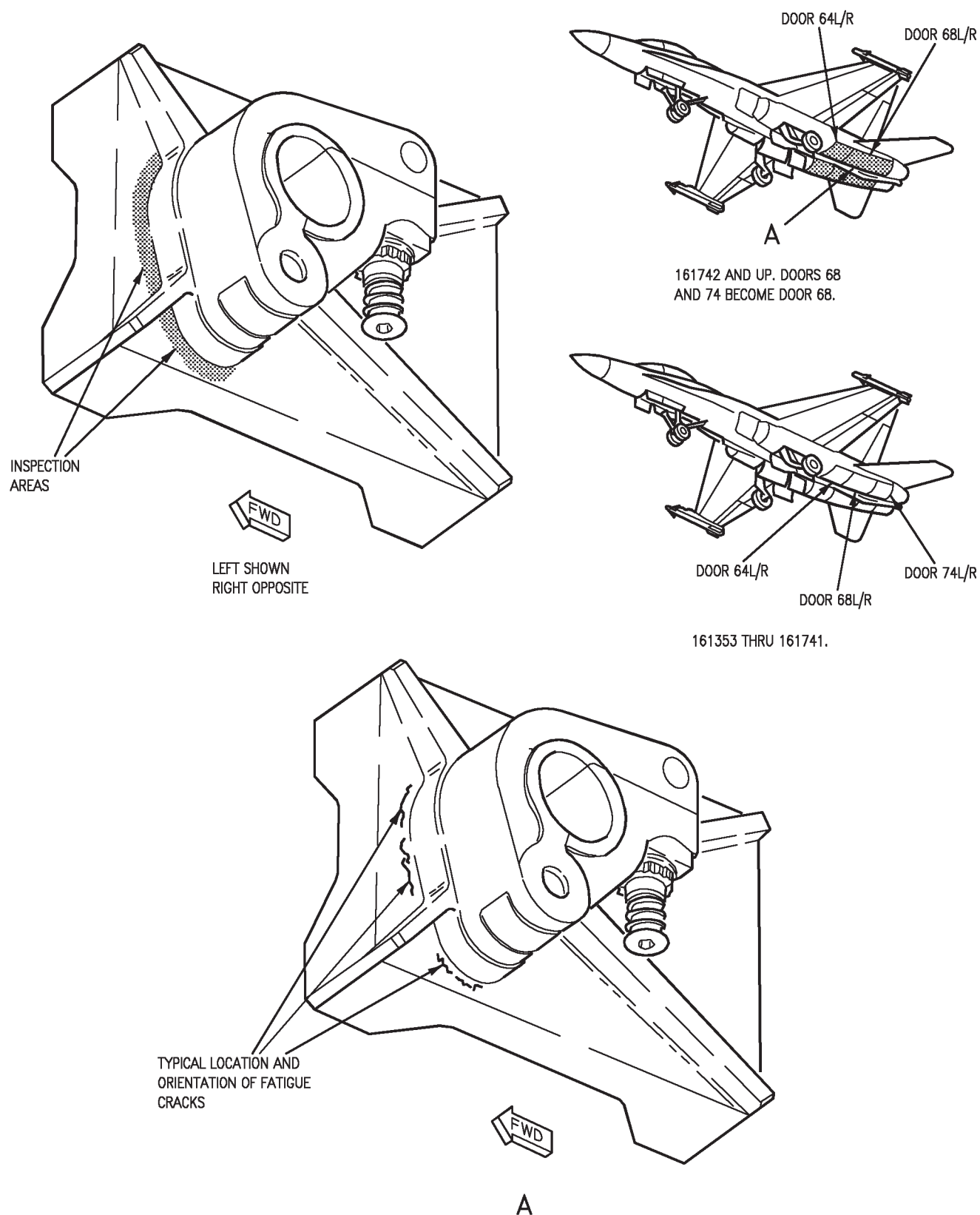
a. Clean inspection materials and marks from engine mount with cleaning cloth moistened with dry cleaning solvent or methyl isobutyl ketone.

b. Restore finish system (NAVAIR 01-1A-509 and A1-F18AC-SRM-500, WP045 00).

## 14. SYSTEM SECURING.

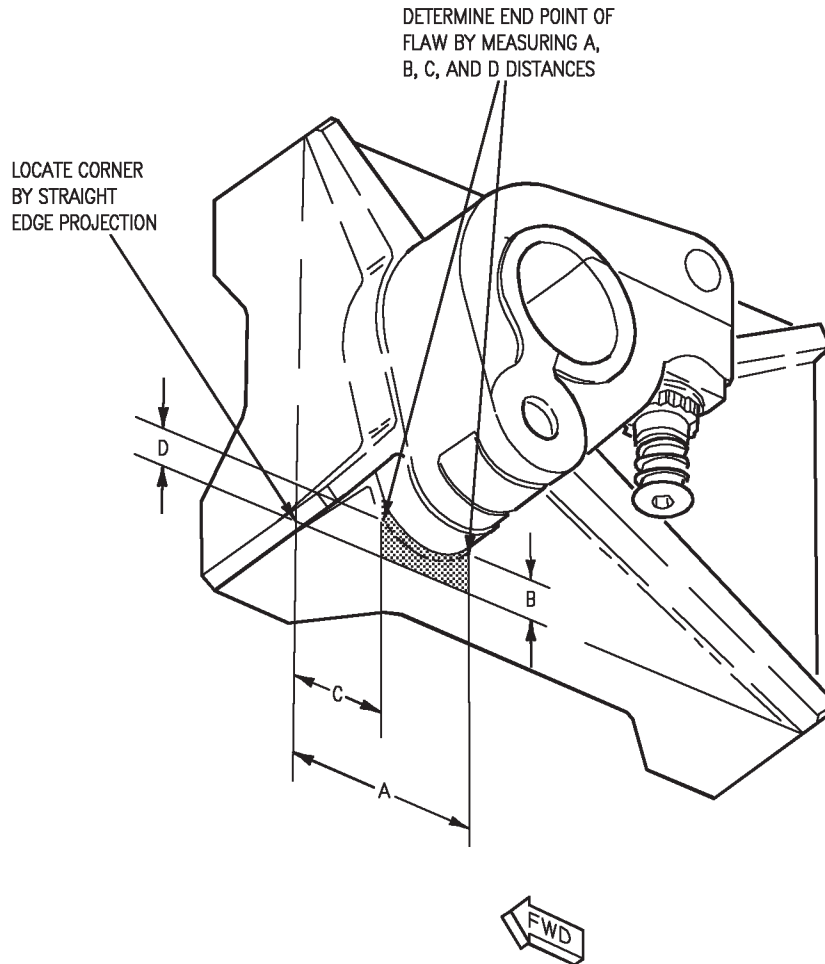
a. Have engine installed (A1-F18AC-270-300, WP003 00).

b. Have engine bay doors closed (A1-F18AC-LMM-010).



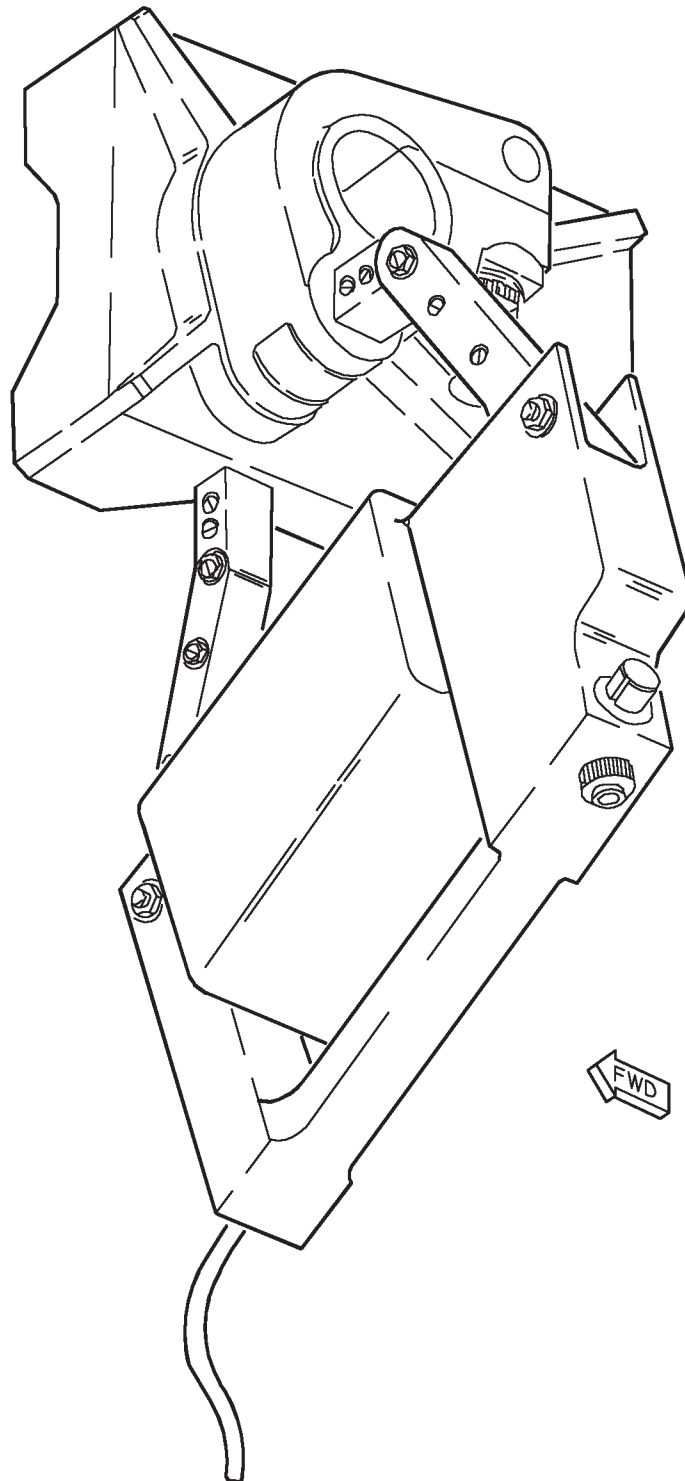
**Figure 1. Engine Mount Inspection Areas and Flaw Locations**





DIMENSION	PENETRANT	MAG PARTICLE
A		
B		
C		
D		

**Figure 2. Flaw Measurement Locations**



**Figure 3. Positioning of Probe**

## INTERMEDIATE MAINTENANCE

## NONDESTRUCTIVE INSPECTION

## HORIZONTAL STABILATOR

## WATER IN HONEYCOMB

## PART NO. 74A210001

## Reference Material

Naval Aviation Maintenance Program .....	OPNAVINST 4790.2
Nondestructive Inspection Methods .....	NAVAIR 01-1A-16
Nondestructive Inspection .....	A1-F18AC-SRM-300
Radiographic Method .....	WP005 00
General Information .....	WP003 00

## Alphabetical Index

Subject	Page No.
Horizontal Stabilator .....	1
Defects .....	1
Primary Inspection Method .....	1

## Record of Applicable Technical Directives

None

1. **HORIZONTAL STABILATOR.**

2. Horizontal stabilator is bonded honeycomb assembly. Honeycomb core is 0.125, 0.156, 0.188, and 0.250 hexagonal cell, 5056 aluminum alloy. Structure enclosing core is 6A1-4V titanium. Skins are graphite epoxy with 6A1-4V titanium splice plate located in spindle area. Surface finish is epoxy primer and polyurethane coating.

3. **DEFECTS.** Inspect for water trapped in honeycomb core. Example of defect is contained in WP003 00.

4. **PRIMARY INSPECTION METHOD.** Primary inspection method is radiographic.

5. **Personnel Qualifications.** Personnel doing this nondestructive inspection should be qualified

and certified to do radiographic inspections per OPNAVINST 4790.2 SERIES, NDI Technicians, NEC 7225/MOS 6044.

## Support Equipment Required

Part Number or Type Designation	Nomenclature
MIL-STD-453	Penetrameter Set
GXR7-6B	X-ray Apparatus, Portable
072000	X-ray Film Processor
314X	Film Identification Set

**Materials Required****NOTE**

Alternate item specifications or part numbers are shown indented.

<b>Specification or Part Number</b>	<b>Nomenclature</b>
INDUSTREX M FILM CODE M2	Radiographic Film, X-ray Film, 14x17
INDUSTREXFILM CODEM25x7	Radiographic Film, X-ray Film 5x7
INDUSTREXAA FILMCOEEAA2 14x17	Radiographic Film, X-ray Film, 14x17
INDUSTREX AA FILMCOEEAA-2	Radiographic Film, X-ray Film, 5x7
MIL-P-83953-2, TYPE 1, CLASS A or B, RED or BLACK	Aircraft Marking Pencil
A-A-883, TYPE 1	Pressure Sensitive Tape

6. **Preparation of Aircraft.** No special preparation required.

7. **Access.** No special access required.

8. **Preparation of Part.** No special preparation required.

**WARNING****HIGH RADIATION**

Make sure applicable safety precautions in WP005 00 and NAVAIR 01-1A-16 are complied with. Failure to comply may result in injury to personnel.

**9. Equipment Settings/Standardization/Setup.**

Set X-ray unit per data contained in technique chart, see figure 1.

**10. Inspection Procedure.****NOTE**

X-ray film for shots are double loaded.  
AA film is located next to part and both films are exposed simultaneously.

a. Locate films 1 and 2 for shot 1. Film should be taped to upper surface of horizontal stabilator with identification markers taped to source side of film pack and penetrameters taped to source side of horizontal stabilator.

b. Locate source to aiming point for shot 1. Source should be normal to aiming point.

c. Expose films 1 and 2 using technique chart settings for shot 1. Remove exposed film.

d. Repeat steps a through c for films 3 through 9 and shots 2 through 8.

e. Repeat steps a through c for films 10 through 12 and shot 9.

f. Repeat steps a through c for films 13 through 18 and shots 10 through 15.

g. Repeat steps a through c for films 19 and 20 and shot 16.

h. Repeat steps a through c for films 21 through 24 and shots 17 through 20.

i. Repeat steps a through c for films 25 and 26 and shot 21.

j. Repeat steps a through c for films 27 and 28 and shot 22.

k. Repeat steps a through c for film 29 and shot 23.

l. Repeat steps a through c for films 30 and 31 and shot 24.

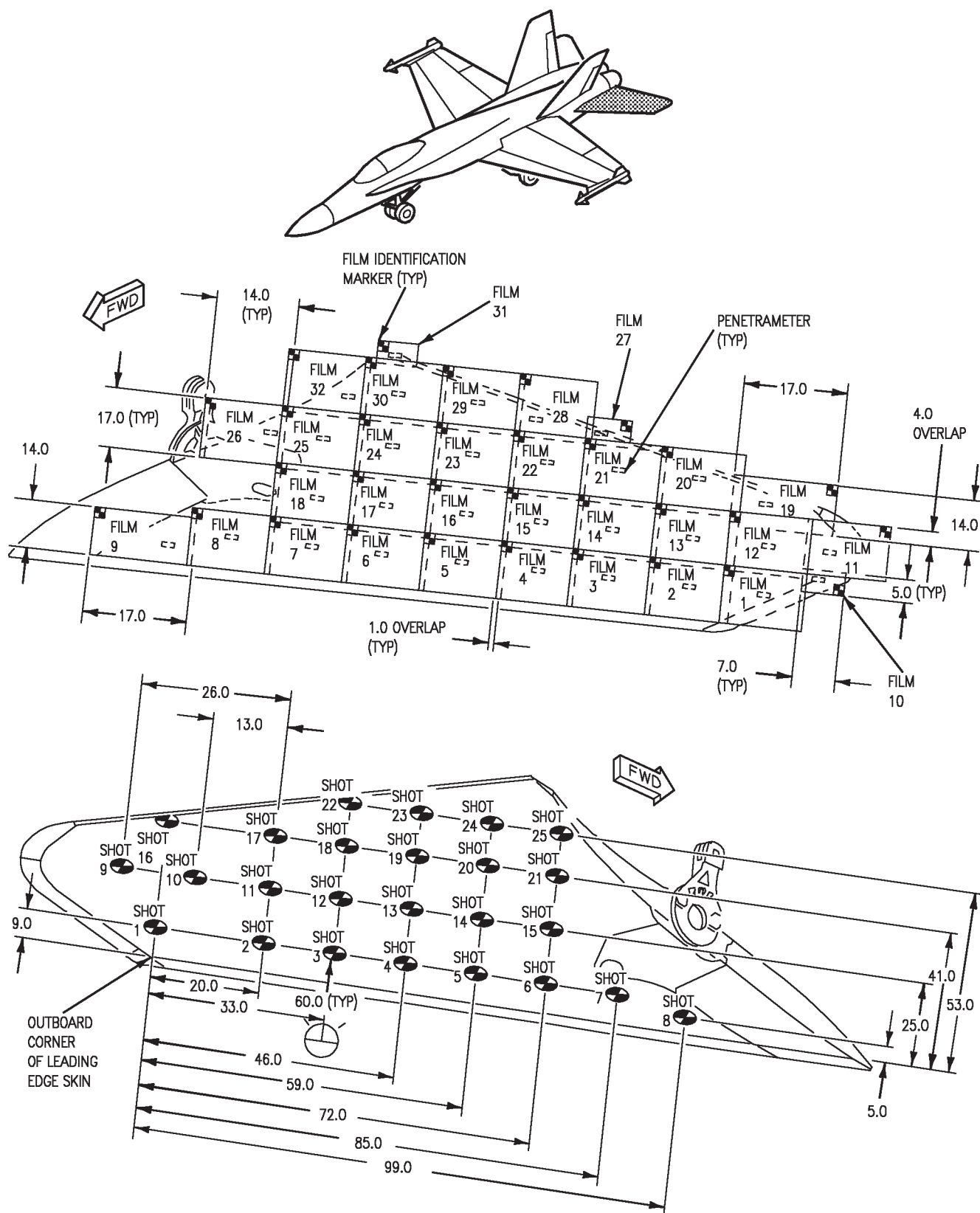
m. Repeat steps a through c for film 32 and shot 25.

n. Repeat steps a through c for films 33 through 36 and shots 26 through 29.

o. Repeat steps a through c for films 37 through 40 and shots 30 through 33.

p. Process exposed film. Interpret radiographs for water trapped in honeycomb core (WP005 00).

q. Mark defect(s) using aircraft marking pencil.



**Figure 1. Horizontal Stabilator, Water in Honeycomb (Sheet 1)**

18AC-SRM-310-(44-1)01-SCAN

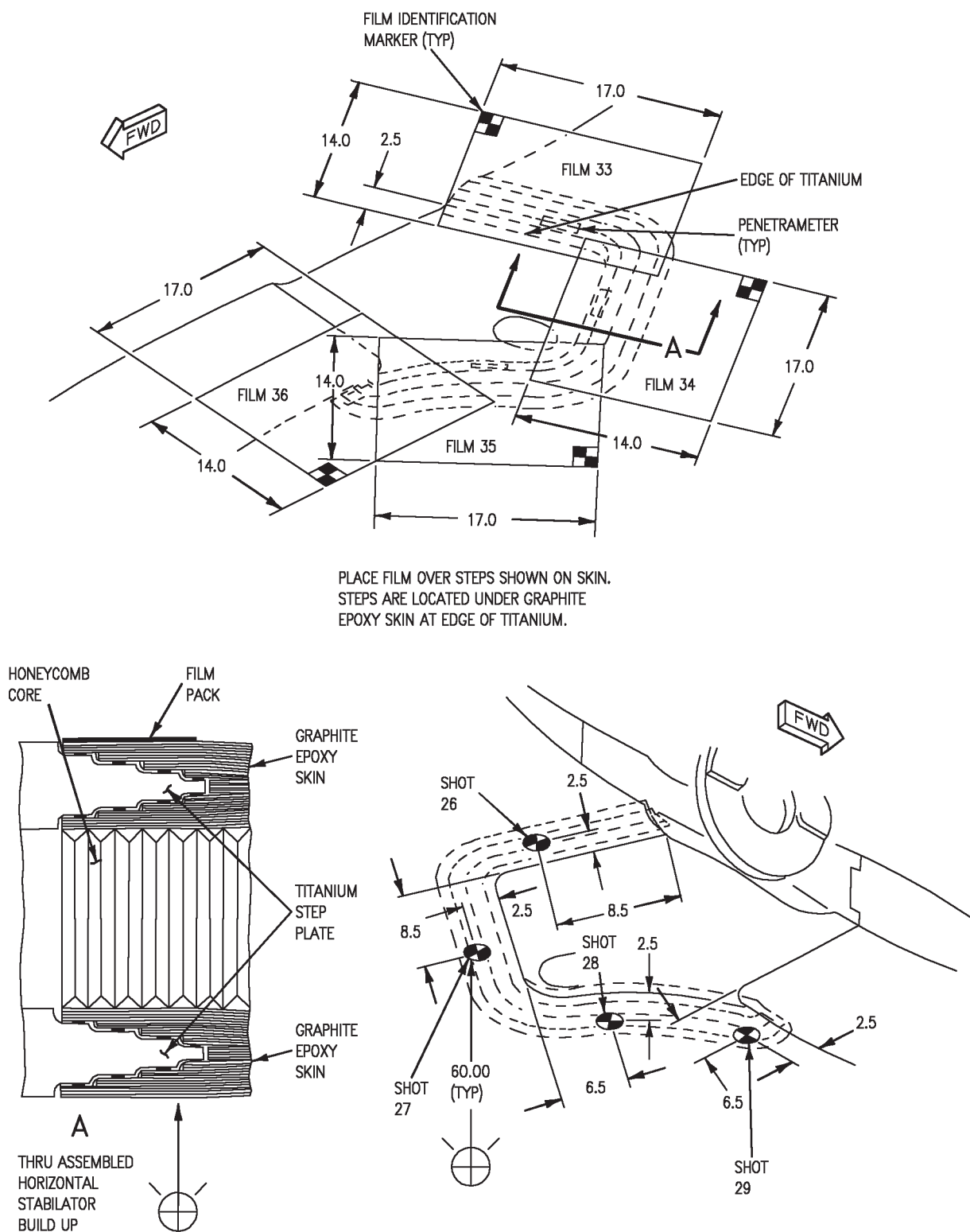


Figure 1. Horizontal Stabilator, Water in Honeycomb (Sheet 2)

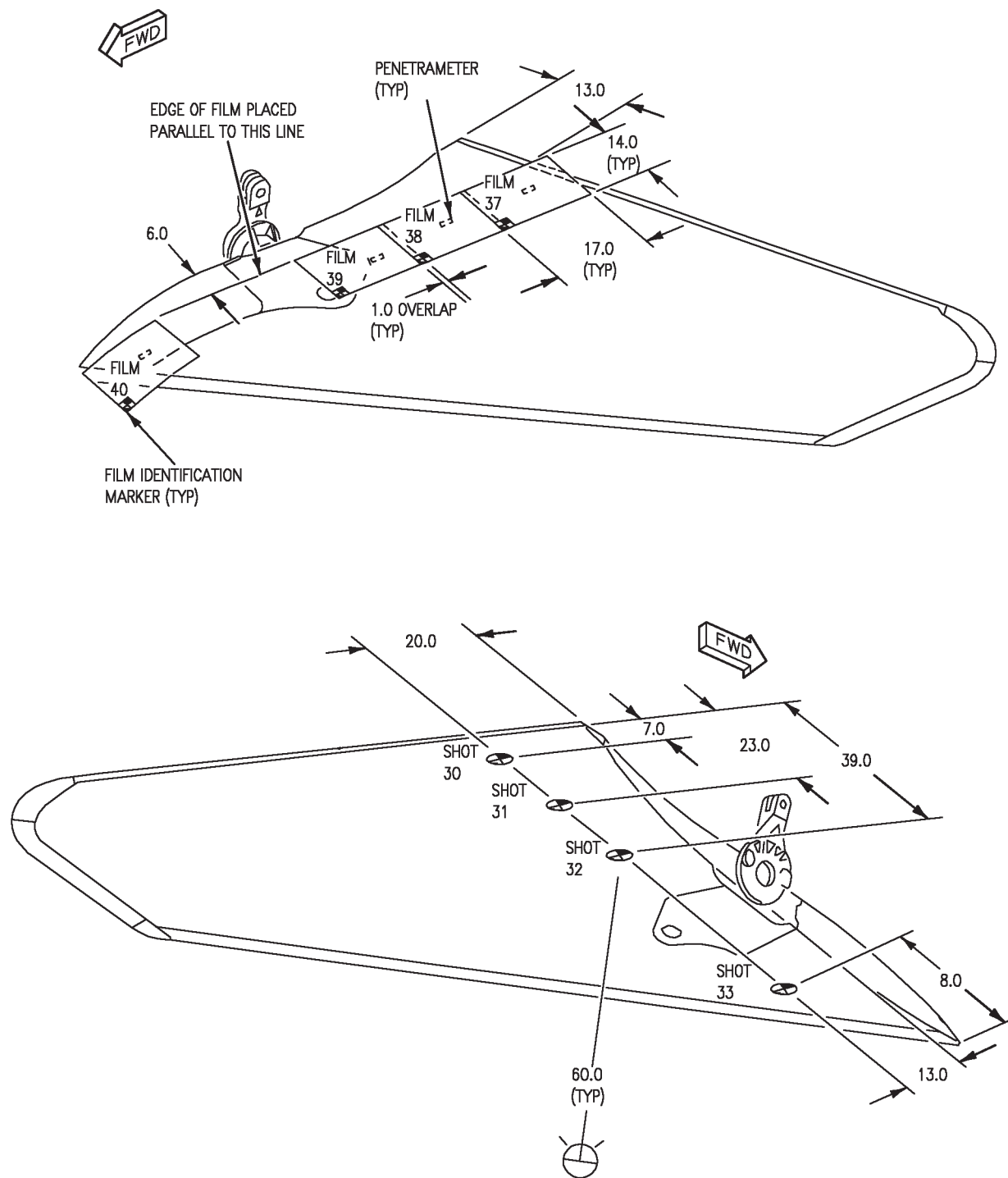



Figure 1. Horizontal Stabilator, Water in Honeycomb (Sheet 3)

TECHNIQUE CHART								
SHOT	FILM SIZE	FILM GROUP	BACK SCREEN	PENETRAMETER MIL-STD-453	mA	kVP	EXPOSURE (MINUTES)	 DENSITY
1	14 X 17	AA AND M	0.010 Pb	0.25 AL	2.5	45	2	1.0 – 3.5
2 THRU 8	14 X 17	AA AND M	0.010 Pb	0.25 AL	2.5	45	2	1.0 – 3.5
9	14 X 17 AND 5 X 7	AA AND M	0.010 Pb	0.25 AL	2.5	45	2	1.0 – 3.5
		AA AND M	0.010 Pb	0.25 AL	2.5	45	2	1.0 – 3.5
10 THRU 15	14 X 17	AA AND M	0.010 Pb	0.25 AL	2.5	45	2	1.0 – 3.5
16	14 X 17	AA AND M	0.010 Pb	0.25 AL	2.5	45	2	1.0 – 3.5
17 THRU 20	14 X 17	AA AND M	0.010 Pb	0.25 AL	2.5	45	2	1.0 – 3.5
21	14 X 17	AA AND M	0.010 Pb	0.25 AL	2.5	45	2	1.0 – 3.5
22	14 X 17 AND 5 X 7	AA AND M	0.010 Pb	0.25 AL	2.5	45	2	1.0 – 3.5
		AA AND M	0.010 Pb	0.25 AL	2.5	45	2	1.0 – 3.5
23	14 X 17	AA AND M	0.010 Pb	0.25 AL	2.5	45	2	1.0 – 3.5
24	14 X 17 AND 5 X 7	AA AND M	0.010 Pb	0.25 AL	2.5	45	2	1.0 – 3.5
		AA AND M	0.010 Pb	0.25 AL	2.5	45	2	1.0 – 3.5
25	14 X 17	AA AND M	0.010 Pb	0.25 AL	2.5	45	2	1.0 – 3.5
26 THRU 29	14 X 17	AA AND M	0.010 Pb	0.37 Ti	4.0	90	2-1/2	1.0 – 3.5
30 THRU 33	14 X 17	AA AND M	0.010 Pb	0.25 Ti	4.0	80	2	1.0 – 3.5

## LEGEND

 H AND D DENSITY UNITS.

Figure 1. Horizontal Stabilator, Water in Honeycomb (Sheet 4)



## INTERMEDIATE MAINTENANCE

## NONDESTRUCTIVE INSPECTION

## HORIZONTAL STABILATOR

## METAL TO METAL BONDLINE

## PART NO. 74A210001/74A210004

This WP supersedes WP054 00, dated 1 April 1993.

## Reference Material

Naval Aviation Maintenance Program .....	OPNAVINST 4790.2
Plane Captain Manual .....	A1-F18AC-PCM-000
Nondestructive Inspection.....	A1-F18AC-SRM-300
Pulse-Echo Longitudinal Wave Contact, Without Delay Line for Metallic Materials.....	WP008 05

## Alphabetical Index

Subject	Page No.
Horizontal Stabilator .....	1
Defects .....	1
Post Inspection Cleaning and Corrosion Control.....	5
Primary Inspection Method .....	1
Ultrasonic Method Using C-398 Ultrasonic Flaw Detector .....	2
Ultrasonic Method Using MXU-715/E Ultrasonic Flaw Detector .....	3

## Record of Applicable Technical Directives

None

## 1. HORIZONTAL STABILATOR.

(WP003 00).

2. Horizontal stabilator is bonded honeycomb assembly. Honeycomb core is 0.125, 0.156, 0.188, and 0.250 inch hexagonal cell aluminum alloy. Skin is graphite epoxy with titanium splice plate in spindle area. Structure enclosing core is titanium spars, ribs, and graphite epoxy rib. Surface finish is epoxy primer and polyurethane coatings.

3. **DEFECTS.** Inspect for metal to metal unbonds. Example of metal to metal unbond is contained in

4. **PRIMARY INSPECTION METHOD.** Primary inspection method is ultrasonic ringing.

5. **Personnel Qualifications.** Personnel doing this nondestructive inspection should be qualified and certified to do ultrasonic inspections per OPNAVINST 4790.2 SERIES, NDI Technicians, NEC 7225/MOS 6044.

6. **Preparation of Aircraft.** No special preparation required.

7. **Access.** No special access required.

8. **ULTRASONIC METHOD USING C-398  
ULTRASONIC FLAW DETECTOR.**

**Support Equipment Required**

**NOTE**

Alternate item type designations or part numbers are listed in parentheses.

<b>Part Number or Type Designation</b>	<b>Nomenclature</b>
C-398 (303B)	Ultrasonic Flaw Detector
57A2271 or EQUIVALENT	Microdot to BNC Connecting Cable
57A2214 or EQUIVALENT	0°, 0.025 Dia., 5 MHz, Contact Delay Line Search Unit
57A4243-30	Test Block, Aluminum, IIW2
—	Single Sheet of Titanium Material, 0.185 Inch

**Materials Required**

<b>Specification or Part Number</b>	<b>Nomenclature</b>
ULTRAGEL II OR EQUIVALENT	Ultrasonic Couplant
M83953-1 or -2	Pencil, Aircraft Marking
020X413	Cleaning Compound
CCCC46TY1CL4	Cloth, Cleaning
COMMERCIAL	Tube Type Marker

9. **Preparation of Part.**

**WARNING**

Cleaning compound is flammable liquid and vapor. May cause allergic respiratory and skin reaction. May cause eye, skin and respiratory irritation. Keep away from heat, sparks, and flame. Do not breathe dust (vapor, mist, gas). Use only with adequate ventilation. Keep container closed. Avoid contact with eyes, skin and clothing. Wash thoroughly after handling.

- a. Clean inspection area(s) of contamination or foreign material using cleaning cloth moistened with cleaning compound. Allow to air dry for 15 minutes.
- b. Locate and mark inspection area per figure 1.

**WARNING**

Make sure safety precautions have been met for electrical, static, grounding when using ultrasonic equipment near aircraft fuel cells, oxygen systems, electrical systems, electronic systems, and stores (A1-F18AC-PCM-000).

10. **Equipment Settings/Standardization/Setup.**

- a. Do general setup including initial equipment settings (WP008 05) except as below:

**NOTE**

Equipment differences may require use of alternate COARSE SWEEP RANGE, FREQ, REP RATE, FINE SWEEP RANGE, VIDEO DISPLAY, DAMPING, and REJECT settings. Minimum REJECT is recommended.

COARSE SWEEP  
DELAY..... 5.0 INCHES  
COARSE SWEEP  
RANGE..... 5.0 INCHES

**NOTE**

Following completion of general setup, initial pulse should be located at 0 on CRT horizontal baseline.

b. Position search unit on aluminum test block as shown in figure 1 to get 4 inch metal travel response of CRT 1.

**NOTE**

GAIN may be adjusted by changing FINE GAIN, COARSE GAIN, or toggling ATTENUATORS.

c. Adjust GAIN and COARSE SWEEP RANGE so peak amplitude of response E is 80 to 90 percent CRT height and leading edge is located at 6 on CRT horizontal baseline. See figure 1, CRT 1.

d. Verify horizontal baseline standardization by positioning search unit to get responses C and D, see figure 1, CRT 2. Adjust GAIN, if required. Move search unit to peak response from 0.060 inch diameter side drilled hole, see figure 1, CRT 2, response C. Amplitudes of responses C and D may not be as shown in CRT 2.

e. Make sure response of 2.00 inch diameter hole is being received.

f. Make sure locations on horizontal baseline are as shown in figure 1, CRT 2. If not, adjust COARSE SWEEP DELAY and COARSE SWEEP LENGTH to locate responses as shown in CRT 2.

g. Standardize CRT amplitudes listed below:

(1) After completion of horizontal time base standardization, apply couplant to single sheet of 0.185 inch thick titanium. See figure 1.

(2) Position search unit on sheet of titanium.

**NOTE**

Do not adjust COARSE SWEEP RANGE or COARSE SWEEP DELAY. Minimum REJECT is recommended.

(3) Adjust GAIN and DAMPING so back surface response multiples located between 6 and 8

on horizontal baseline are 30 to 50 percent CRT height. See figure 1, CRT 3.

**11. Inspection Procedure.****WARNING**

Couplant may cause eye irritation. Avoid contact with eyes. Wash thoroughly after handling.

**NOTE**

Procedure is able to detect outer titanium to adhesive unbonds only. When adhesive is attached to outer titanium and unbonded from inner titanium structure, response may be very similar to good bond response. Couplant thickness and search unit finger pressure may change ringing response.

a. Apply couplant to inspection area.

b. Position search unit on inspection area.

c. Inspect bondlines by monitoring ringing response. Unbond response is shown in CRT 3. Good bond response is shown in CRT 4.

d. Mark all areas of unbond response with aircraft marking pencil.

e. Record all areas of unbond response.

f. Do paragraph 16.

**12. ULTRASONIC METHOD USING MXU-715/E ULTRASONIC FLAW DETECTOR.****Support Equipment Required**

Part Number or Type Designation	Nomenclature
1642AS100-1	Ultrasonic Flaw Detector, MXU-715/E, Magnaflux
57A2271 or EQUIVALENT	Microdot to BNC Connecting Cable

### Support Equipment Required (Continued)

Part Number or Type Designation	Nomenclature
57A2214 or EQUIVALENT	0°, 0.025 Dia., 5 MHz, Contact Delay Line Search Unit
57A4243-30	Test Block, Aluminum, IIW2
—	Single Sheet of Titanium Material, 0.185 Inch

### Materials Required

Specification or Part Number	Nomenclature
ULTRAGEL II OR EQUIVALENT	Ultrasonic Couplant
M83953-1 or -2	Pencil, Aircraft Marking
020X413	Cleaning Compound
CCCC46TY1CL4	Cloth, Cleaning
COMMERCIAL	Tube Type Marker

#### 13. Preparation of Part.

#### WARNING

Cleaning compound is flammable liquid and vapor. May cause allergic respiratory and skin reaction. May cause eye, skin and respiratory irritation. Keep away from heat, sparks, and flame. Do not breathe dust (vapor, mist, gas). Use only with adequate ventilation. Keep container closed. Avoid contact with eyes, skin and clothing. Wash thoroughly after handling.

a. Clean inspection area(s) of contamination or foreign material using cleaning cloth moistened with cleaning compound. Allow to air dry for 15 minutes.

b. Locate and mark inspection area per figure 1.

#### WARNING

Make sure safety precautions have been met for electrical, static, grounding when using ultrasonic equipment near aircraft fuel cells, oxygen systems, electrical systems, electronic systems, and stores (A1-F18AC-PCM-000).

#### 14. Equipment Settings/Standardization/Setup.

#### NOTE

Equipment differences may require use of alternate REP. RATE, DAMP., FREQ., GAIN, AND HORIZONTAL SWEEP DELAY and LENGTH.

a. Do general setup including initial equipment settings (WP008 05) except as below:

HORIZONTAL SWEEP DELAY	
COURSE .....	50 INCHES
FINE.....	9.1
HORIZONTAL SWEEP LENGTH	
COURSE.....	10 INCHES
FINE .....	3.4 INCHES

#### NOTE

Following completion of general setup, initial pulse should be located at 0 on CRT horizontal baseline.

b. Position search unit on aluminum test block as shown in figure 1 to get 4 inch metal travel response of CRT 1.

c. Adjust GAIN and HORIZONTAL SWEEP LENGTH so peak amplitude of response E is 80 to 90 percent CRT height and leading edge is located at 6 on CRT horizontal baseline. See figure 1, CRT 1.

d. Verify horizontal baseline standardization by positioning search unit to get responses C and D, see figure 1, CRT 2. Adjust GAIN, if required. Move search unit to peak response from 0.060 inch diameter side drilled hole, see figure 1, CRT 2,

response C. Amplitudes of responses C and D may not be as shown in CRT 2.

e. Make sure response of 2.00 inch diameter hole is being received.

f. Make sure locations on horizontal baseline are as shown in figure 1, CRT 2. If not, adjust HORIZONTAL SWEEP DELAY and LENGTH to locate responses as shown in CRT 2.

g. Standardize CRT amplitudes listed below:

(1) After completion of horizontal time base standardization, apply couplant to single sheet of 0.185 inch thick titanium. See figure 1.

(2) Position search unit on sheet of titanium.

### NOTE

Do not adjust HORIZONTAL SWEEP LENGTH or DELAY. Minimum REJECT is recommended.

(3) Adjust GAIN and DAMPING so back surface response multiples located between 6 and 8 on horizontal baseline are 30 to 50 percent CRT height. See figure 1, CRT 3.

### 15. Inspection Procedure.

### WARNING

Couplant may cause eye irritation. Avoid contact with eyes. Wash thoroughly after handling.

### NOTE

Procedure is able to detect outer titanium to adhesive unbonds only. When adhesive is attached to outer titanium and unbonded from inner titanium structure, response may be very similar to good bond response. Couplant thickness and search unit finger pressure may change ringing response.

a. Apply couplant to inspection area.

b. Position search unit on inspection area.

c. Inspect bondlines by monitoring ringing response. Unbond response is shown in CRT 3. Good bond response is shown in CRT 4.

d. Mark all areas of unbond response with aircraft marking pencil.

e. Record all areas of unbond response.

### WARNING

Cleaning compound is flammable liquid and vapor. May cause allergic respiratory and skin reaction. May cause eye, skin and respiratory irritation. Keep away from heat, sparks, and flame. Do not breathe dust (vapor, mist, gas). Use only with adequate ventilation. Keep container closed. Avoid contact with eyes, skin and clothing. Wash thoroughly after handling.

**16. POST INSPECTION CLEANING AND CORROSION CONTROL.** Clean couplant and markings from inspection area using cleaning cloth moistened with cleaning compound. Allow to air dry for 15 minutes.

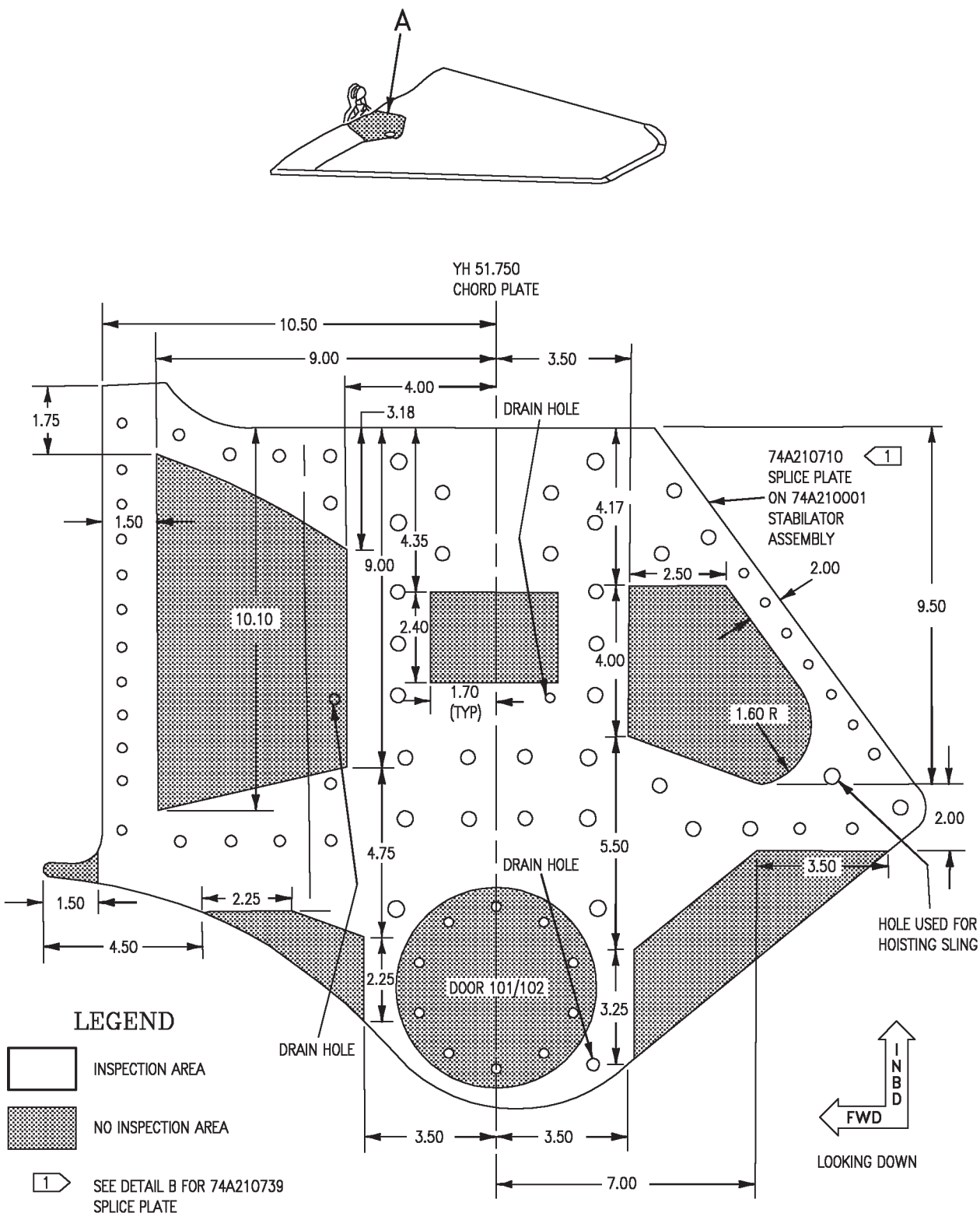
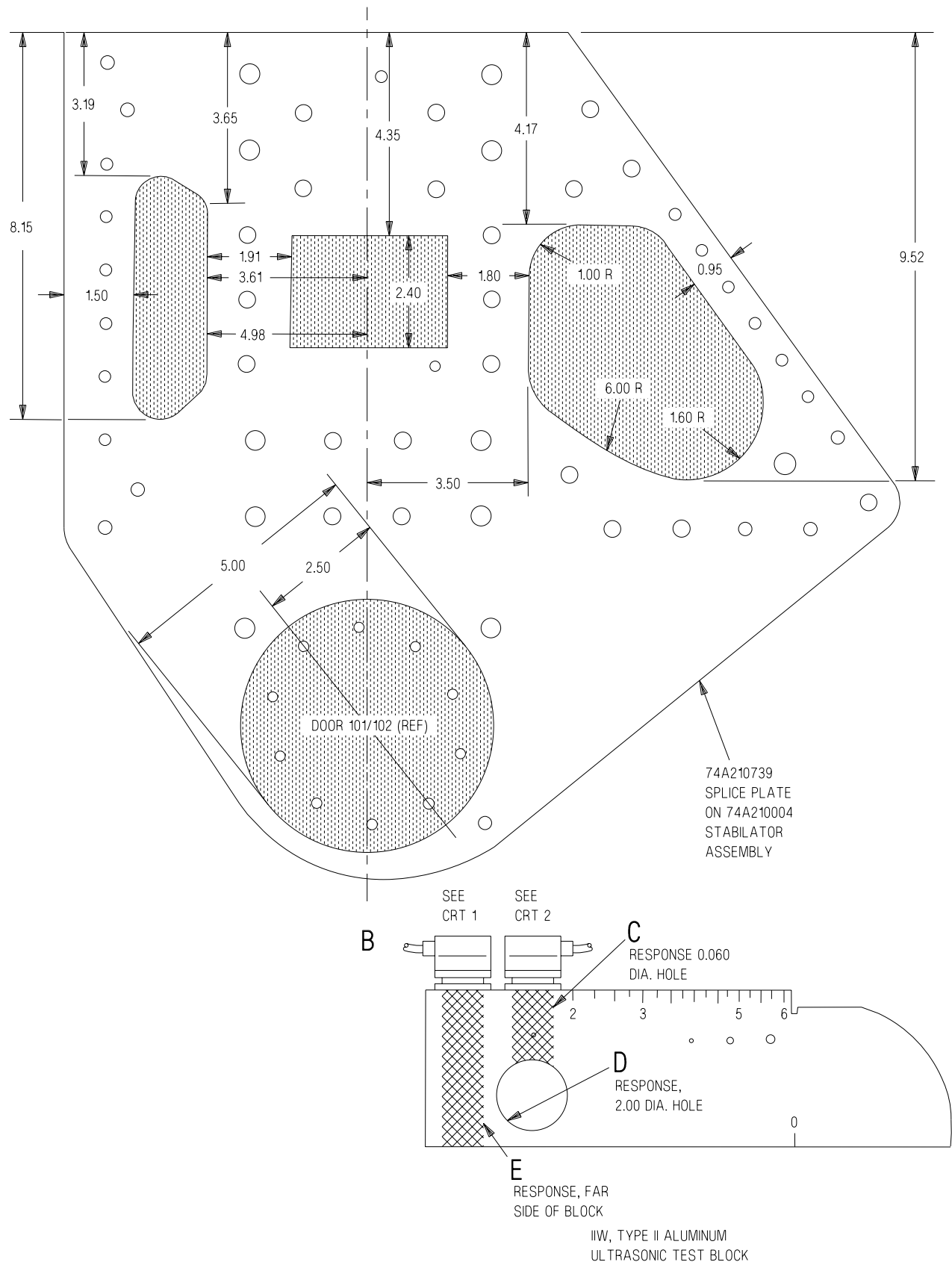
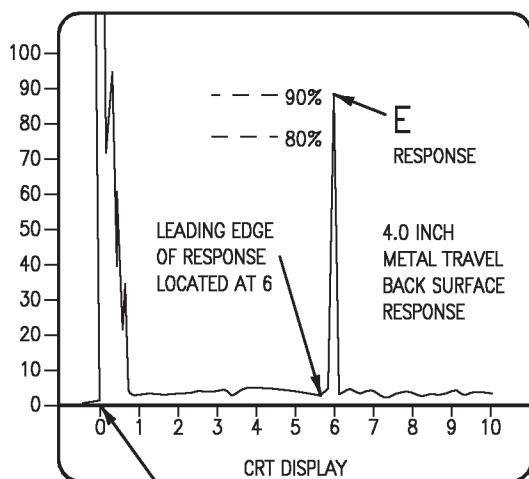


Figure 1. Horizontal Stabilizer, Metal to Metal Bondline (Sheet 1)



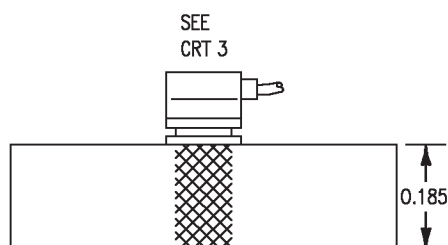
**Figure 1. Horizontal Stabilizer, Metal to Metal Bondline (Sheet 2)**



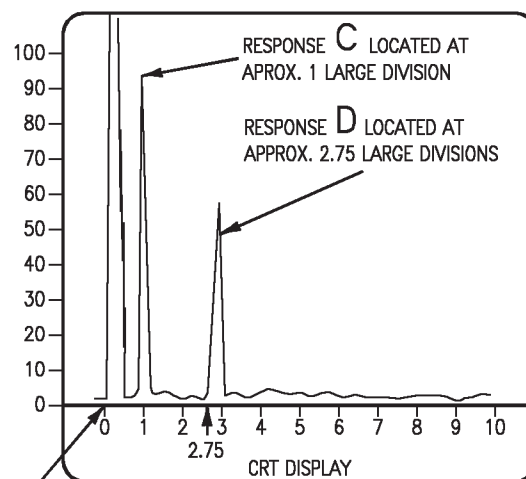
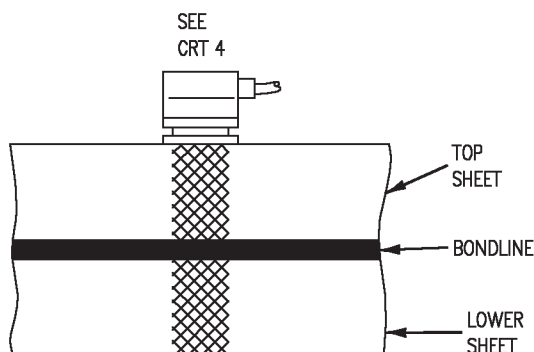


CRT 1

LEADING EDGE OF INITIAL PULSE LOCATED AT ZERO

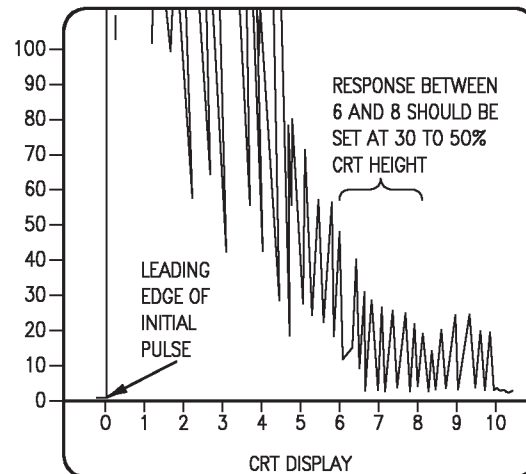


SINGLE SHEET OF TITANIUM MATERIAL APPROX. 0.185. MAKE SURE BACK SURFACE IS FREE OF ANY BONDED OR COUPLANT MATERIAL WHICH MAY DAMP REFLECTED SIGNALS.



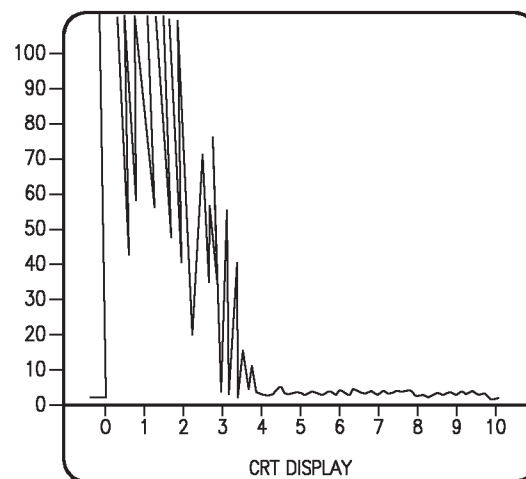
CRT 2

LEADING EDGE OF INITIAL PULSE LOCATED AT ZERO



CRT 3

SINGLE SHEET UNBOND RESPONSE



CRT 4

GOOD BOND RESPONSE

Figure 1. Horizontal Stabilator, Metal to Metal Bondline (Sheet 3)



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**INTERMEDIATE MAINTENANCE****NONDESTRUCTIVE INSPECTION****HORIZONTAL STABILATOR****SKIN TO CORE UNBONDS AND SKIN DELAMINATIONS/SKIN TO CLOSURE UNBONDS AND SKIN DELAMINATIONS****PART NO. 74A210001**

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**Reference Material**

Plane Captain Manual .....	A1-F18AC-PCM-000
Naval Aviation Maintenance Program .....	OPNAVINST 4790.2
Nondestructive Inspection.....	A1-F18AC-SRM-300
General Information .....	WP003 00
Ultrasonic Through Transmission Contact Testing, Standardization, and Inspection Procedures for Composite Laminate Skins Bonded to Honeycomb Core.....	WP008 01
Pulse-Echo, Longitudinal Wave Contact Without Delay Line, for Composite Laminate Material .....	WP008 02
Pulse-Echo, Longitudinal Wave Contact With Delay Line, for Composite Laminate Material Bonded to Honeycomb Core .....	WP008 04
Ultrasonic Resonance Inspection With Fokker Bond Tester.....	WP008 06
Ultrasonic Through Transmission Contact Testing, Standardization, and Inspection Procedures for Composite Laminates and Metallic Skins Bonded to Honeycomb Core .....	WP008 10
Pulse-Echo Longitudinal, Contact, Without Delay Line, for Composite Laminate Materials.....	WP008 11
Pulse-Echo Longitudinal, Contact, With Delay Line, for Composite Laminate Materials.....	WP008 12
Pulse-Echo Shear Wave, Angle Beam, Contact of Metallic Materials .....	WP008 14

**Alphabetical Index**

<b>Subject</b>	<b>Page No.</b>
Horizontal Stabilator .....	2
Defects .....	2
Post Inspection Cleaning and Corrosion Control.....	11
Primary Inspection Method .....	2
Ultrasonic Method Using C-398 Ultrasonic Flaw Detector .....	2
Ultrasonic Method Using MXU-715/E Ultrasonic Flaw Detector .....	8

## Record of Applicable Technical Directives

None

1. **HORIZONTAL STABILATOR.** See figure 1.

2. Horizontal stabilator is bonded honeycomb assembly. Honeycomb core is 0.125, 0.156, 0.188, and 0.250 inch hexagonal cell aluminum alloy. Skin is graphite epoxy with titanium splice plate in spindle area. Structure enclosing core is titanium spars, ribs, and graphite epoxy rib. Surface finish is epoxy primer and polyurethane coatings.

3. **DEFECTS.** Inspect for skin to core and skin to closure unbonds. Example of skin to core unbonds that may develop in bonded assembly is contained in (WP003 00).

4. **PRIMARY INSPECTION METHOD.** Primary inspection method is ultrasonic.

5. **Personnel Qualifications.** Personnel doing this nondestructive inspection should be qualified and certified to do ultrasonic inspections per OPNAVINST 4790.2 SERIES, NDI Technicians, NEC 7225/MOS 6044.

6. **Preparation of Aircraft.** No special preparation required.

7. **Access.** No special access required.

8. **ULTRASONIC METHOD USING C-398  
ULTRASONIC FLAW DETECTOR.**Support Equipment Required  
(Continued)

## NOTE

Alternate item type designations or part numbers are listed in parentheses.

Part Number or Type Designation	Nomenclature
57A2271 or EQUIVALENT	Microdot to BNC Connecting Cable, 2 Reqd.
57A2214 or EQUIVALENT	0°, 0.250 Dia., 5 MHz, Contact Search Unit, 2 Reqd.
57A7101 or EQUIVALENT	0°, 0.500 Dia., 1 MHz, Contact Search Unit, 2 Reqd.
57A2276 or EQUIVALENT	0°, 0.500 Dia., 2.25 MHz, Contact Search Unit
74D110175-1001	Graphite Epoxy Ultrasonic Reference Standard Set:
74D111295-1005	Honeycomb Reference Standard with Graphite Epoxy Skin for Sandwich Assemblies Less Than 1 Inch Thick
74D111295-1003	Honeycomb Reference Standard with Graphite Epoxy Skins for Sandwich Assemblies 1 to 2 Inches Thick
74D111295-1001	Honeycomb Reference Standard with Graphite Epoxy Skins for Sandwich Assemblies 2 Inches or Taller
74D111295-1009	Graphite Epoxy Flat Bottom Hole Refer- ence Standard for Laminates up to 0.450

## Support Equipment Required

## NOTE

Alternate item type designations or part numbers are listed in parentheses.

Part Number or Type Designation	Nomenclature
C-398 (303B)	Ultrasonic Flaw Detector
3814	Fokker Probe
Model 80	Fokker Bond Tester
Yellow Bond Tester Adapter	Probe Adapter Assembly

**Materials Required****NOTE**

Alternate item specifications or part numbers are shown indented.

Specification or Part Number	Nomenclature
ULTRAGEL II OR EQUIVALENT	Couplant
CCC-C-46, TYPE 1, CLASS 4	Cleaning Cloth
MIL-P-83953-2, TYPE 1, CLASS A or B, RED or BLACK	Aircraft Marking Pencil
673T	Tube Type Marker
P-D-680, TYPE 2, D 1153	Dry Cleaning Solvent Methyl Isobutyl Ketone

**9. Preparation of Part.****WARNING**

Dry cleaning solvent and methyl isobutyl ketone are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

a. Clean both surfaces of inspection area(s) with solvent moistened cloth to make sure inspection area(s) is free of contamination or foreign material.

b. On horizontal stabilator surface locate, mark, and identify inspection areas, core splice lines, and boundaries as shown in figures 1 and 2.

**WARNING**

Make sure safety precautions have been met for electrical, static, grounding when using eddy current equipment near aircraft fuel cells, oxygen systems, electrical systems, and stores (A1-F18AC-PCM-000).

**10. Equipment Settings/Standardization/Setup for Skin to Core Areas.** See figures 3, 4, and 5.**NOTE**

Equipment differences may require use of alternate REP. RATE, DAMP., FREQ., GAIN, and SWEEP DELAY and SWEEP LENGTH.

a. Do general setup procedure, including initial equipment settings (WP008 01).

b. For areas on horizontal stabilator, select graphite epoxy skinned honeycomb reference standard for part thickness in inspection area. For splice plate areas, use reference standard specified for 2 inches or taller core (WP008 01).

c. Do standardization (WP008 01) except as below:

(1) Use two 0°, 0.500 inch diameter, 2.25 MHz, contact search units, 57A2214 or equivalent, for all areas except splice plate areas.

(2) For splice plate areas on horizontal stabilator, use two 0°, 0.500 inch diameter, 1 MHz, contact search units, 57A7101 or equivalent.

(3) Use P-1 calibration point on graphite epoxy reference standards (WP008 01).

(4) Make sure correct response if being viewed by removing microdot cable from R BNC jack and observing total disappearance of received response.

**11. Inspection Procedure for Skin to Core Areas.** See figures 6, 7, and 8.

a. Do inspection procedure (WP008 01) except as below:

(1) Use two 0°, 0.500 inch diameter, 2.25 MHz contact search units for all areas except splice plate areas.

(2) For splice plate areas on horizontal stabilator, use two 0°, 0.500 inch diameter, 1 MHz contact search units.

(3) Make sure initial pulse width does not interfere with location of received response. If required, use different search unit on receiver cable.

(4) For splice plate areas, scan parallel to steps. Decrease in response peak amplitude may occur when crossing steps. Flaw response will be similar to figure 9, CRT 2.

(5) Mark all areas with aircraft marking pencil where through transmission received response falls below 5 percent CRT height, even with addition of 6 dB gain, or if leading edge of received response is shifted more than 1-1/2 large division on CRT horizontal baseline. For examples of flaw responses (WP008 01).

(6) Use ultrasonic pulse-echo method (WP008 04) to determine if above marked area, substep (5), is result of skin delamination. Do pulse-echo inspection on both surfaces to help identify location of flaw causing through transmission unbond response. Use figure 10 to identify skin thickness in marked areas.

## NOTE

Equipment differences may require use of alternate REP. RATE, DAMP., FREQ., GAIN, and SWEEP DELAY and SWEEP RANGE.

**12. Equipment Settings/Standardization/Setup For Trailing Edge Arrowhead On Horizontal Stabilator.** Do general setup, including initial equipment settings and 74D111295-1009 reference standard (WP008 02) except, use 0°, 0.375 inch diameter, 2.25 MHz search unit.

## NOTE

Following completion of general setup, initial pulse leading edge should be located at 0 on CRT horizontal baseline. See figure 11, CRT 1.

### 13. Inspection Procedure For Trailing Edge Arrowhead On Horizontal Stabilator, Skin, To Closure Area.

a. Use aircraft marking pencil to mark inspection area on stabilator composite skin to trailing edge closure arrowhead, see figure 11.

b. Apply couplant to one side of inspection area.

c. Locate trailing edge of initial pulse at 3 on CRT horizontal baseline as shown in figure 11, CRT 1.

## NOTE

GAIN may be adjusted by changing FINE GAIN, COARSE GAIN, and Toggling ATTENUATORS.

d. Position search unit on inspection area and adjust GAIN so reflected response has peak amplitude of about 80 percent CRT height, as shown in figure 11, CRT 2.

e. Scan area to be inspected while finger damping opposite surface. Place couplant on end of finger and touch opposite surface of inspection area. As finger touches surface and is removed from skin, reflected responses will move up and down, damp, on CRT indicating good bond.

f. Unbond or delamination will result in loss of reflected signal on CRT, see figure 12, CRT 1.

g. Mark all areas with aircraft marking pencil where reflected response is lost or cannot be finger damped, see figure 12, CRT 2.

h. Use ultrasonic pulse-echo method (WP008 03) to determine if above marked area is result of skin delamination. Use figure 10 to identify skin thickness in area marked.

**14. Equipment Settings/Standardization/Setup For Skin to Closure Area.** See figure 13. For skin to closure bondline at leading edge, do equipment

Settings/Standardization/Setup for model 80 Fokker Bond Tester (WP008 06) except as below:

- a. Set (bond tester) front face settings:

DSP..... ACTIVATED  
 MODE ..... M  
 S (SWEEP RATE) ..... 1  
 R (SWEEP RANGE) .... 5  
 F (FREQUENCY  
 BAND)..... 5

#### NOTE

It is important to use correct amount of couplant. Not enough couplant will give incorrect response.

- b. Apply couplant to skin to core area shown in figure 14.

- c. Position probe on skin to core area.

- d. Use FREQ. FINE and GAIN to get unbond A-scale response of  $0 \pm 1$  KHz and B-scale response of approximately 100. See figure 14, display 1.

- e. Reposition probe over known nearby good bond area and observe good bond response. For this procedure, typical good bond response has A-scale display between -20 and -40 KHz and B-scale display of 122, B-scale maximum, see figure 14, display 2.

#### 15. Inspection Procedures For Skin To Closure

**Area.** For skin to closure bondline at leading edge, do Inspection Procedure (WP008 06) except as below:

- a. Outline inspection area with aircraft marking pencil, see figure 13.

- b. Apply couplant to inspection area. Use distilled water if leading edge of skin is open to edge.

- c. Position probe on upper or lower surface of inspection area.

#### NOTE

When abnormal amount of fairing material or metal strap doubler has been used in skin to closure area, delete inspection in this area. Abnormal amount of fairing material is indicated by A-scale air response even with correct coupling.

- d. Inspect skin to closure bondline by monitoring A-scale numeric display. Maintain good coupling because air responses will appear similar to unbond response. Use scan index of 3/16 inch or half probe diameter.

- e. Areas displaying A-scale response of -5 KHz through 5 KHz indicate unbond.

- f. Mark all unbond response area with aircraft marking pencil.

- g. Do paragraph 24.





## 16. ULTRASONIC METHOD USING MXU-715/E ULTRASONIC FLAW DETECTOR.

### Support Equipment Required

Part Number or Type Designation	Nomenclature
1642AS100-1	Ultrasonic Flaw Detector, MXU-715/E, Magnaflux
3814	Fokker Probe
Model 80	Fokker Bond Tester
Yellow Bond Tester Adapter	Probe Adapter Assem- bly
57A2271 or EQUIVALENT	Microdot to BNC Connecting Cable, 2 Req'd.
57A2214 or EQUIVALENT	0°, 0.250 Dia., 5 MHz, Contact Search Unit, 2 Req'd.
57A7101 or EQUIVALENT	0°, 0.500 Dia., 1 MHz, Contact Search Unit, 2 Req'd.
57A2276 or EQUIVALENT	0°, 0.500 Dia., 2.25 MHz, Contact Search Unit
74D1110175-1001	Graphite Epoxy Ultrasonic Reference Standard Set:
74D111295-1005	Honeycomb Reference Standard with Graphite Epoxy Skin for Sandwich Assemblies Less Than 1 Inch Thick
74D111295-1003	Honeycomb Reference Standard with Graphite Epoxy Skins for Sandwich Assemblies 1 to 2 Inches Thick
74D111295-1001	Honeycomb Reference Standard with Graphite Epoxy Skins for Sandwich Assemblies 2 Inches or Taller

## Support Equipment Required (Continued)

Part Number or Type Designation	Nomenclature
74D111295-1009	Graphite Epoxy Flat Bottom Hole Refer- ence Standard for Laminates up to 0.450

### Materials Required

#### NOTE

Alternate item specifications or part numbers are shown indented.

Specification or Part Number	Nomenclature
ULTRAGEL II OR EQUIVALENT	Couplant
CCC-C-46, TYPE 1, CLASS 4	Cleaning Cloth
MIL-P-83953-2, TYPE 1, CLASS A or B, RED or BLACK	Aircraft Marking Pencil
COMMERCIAL P-D-680, TYPE 2, D 1153	Tube Type Marker Dry Cleaning Solvent Methyl Isobutyl Ketone

## 17. Preparation of Part.

### WARNING

Dry cleaning solvent and methyl isobutyl ketone are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.



a. Clean both surfaces of inspection area(s) with solvent moistened cloth to make sure inspection area(s) is free of contamination or foreign material.

b. On horizontal stabilator surface locate, mark, and identify inspection areas, core splice lines and boundaries as shown in figures 1 and 2.

**WARNING**

Make sure safety precautions have been met for electrical, static, grounding when using eddy current equipment near aircraft fuel cells, oxygen systems, electrical systems, and stores (A1-F18AC-PCM-000).

**18. Equipment Settings/Standardization/Setup for Skin to Core Areas.****NOTE**

Equipment differences may require use of alternate REP. RATE, DAMP., FREQ., GAIN, and HORIZONTAL SWEEP DELAY and LENGTH.

a. Do general setup procedure, including initial equipment settings (WP008 10).

b. For areas on horizontal stabilator, select graphite epoxy skinned honeycomb reference standard for part thickness in inspection area. For splice plate areas, use reference standard specified for 2 inches or taller core (WP008 10).

c. Do standardization (WP008 10) except as below:

(1) Use two 0°, 0.500 inch diameter, 2.25 MHz, contact search units, 57A2214 or equivalent, for all areas except splice plate areas.

(2) For splice plate areas on horizontal stabilator, use two 0°, 0.500 inch diameter, 1 MHz, contact search units, 57A7101 or equivalent.

(3) Use P-1 calibration point on graphite epoxy reference standards (WP008 10).

(4) Make sure correct response if being viewed by removing microdot cable from R BNC jack and observing total disappearance of received response.

**19. Inspection Procedure for Skin to Core Areas.**

a. Do inspection procedure (WP008 10) except as below:

(1) Use two 0°, 0.500 inch diameter, 2.25 MHz contact search units for all areas except splice plate areas.

(2) For splice plate areas on horizontal stabilator, use two 0°, 0.500 inch diameter, 1 MHz contact search units.

(3) Make sure initial pulse width does not interfere with location of received response. If required, use different search unit on receiver cable.

(4) For splice plate areas, scan parallel to steps. Decrease in response peak amplitude may occur when crossing steps. Flaw response will be similar to figure 10, CRT 2.

(5) Mark all areas with aircraft marking pencil where through transmission received response falls below 5 percent CRT height, even with addition of 6 dB gain, or if leading edge of received response is shifted more than 1-1/2 large division on CRT horizontal baseline. For examples of flaw responses (WP008 10).

(6) Use ultrasonic pulse-echo method (WP008 13) to determine if above marked area, substep (5), is result of skin delamination. Do pulse-echo inspection on both surfaces to help identify location of flaw causing through transmission unbond response. Use figure 7 to identify skin thickness in marked areas.

**NOTE**

Equipment differences may require use of alternate REP. RATE, DAMP., FREQ., GAIN, and HORIZONTAL SWEEP DELAY and LENGTH.

**20. Equipment Settings/Standardization/Setup For Trailing Edge Arrowhead On Horizontal Stabilator.** Do general setup, including initial equipment settings and 74D111295-1009 reference standard (WP008 11) except, use 0°, 0.375 inch diameter, 2.25 MHz search unit.

**NOTE**

Following completion of general setup, initial pulse leading edge should be located at 0 on CRT horizontal baseline. See figure 11, CRT 1.

### 21. Inspection Procedure For Trailing Edge Arrowhead On Horizontal Stabilator, Skin, To Closure Area.

- a. Use aircraft marking pencil to mark inspection area on stabilator composite skin to trailing edge closure arrowhead, see figure 11.
- b. Apply couplant to one side of inspection area.
- c. Locate trailing edge of initial pulse at 3 on CRT horizontal baseline as shown in figure 11, CRT 1.
- d. Position search unit on inspection area and adjust GAIN so reflected response has peak amplitude of about 80 percent CRT height, as shown in figure 11, CRT 2.
- e. Scan area to be inspected while finger damping opposite surface. Place couplant on end of finger and touch opposite surface of inspection area. As finger touches surface and is removed from skin, reflected responses will move up and down, damp, on CRT indicating good bond.
- f. Unbond or delamination will result in loss of reflected signal on CRT, see figure 12, CRT 1.
- g. Mark all areas with aircraft marking pencil where reflected response is lost or cannot be finger damped, see figure 12, CRT 2.
- h. Use ultrasonic pulse-echo method (WP008 12) to determine if above marked area is result of skin delamination. Use figure 7 to identify skin thickness in area marked.

**22. Equipment Settings/Standardization/Setup For Skin to Closure Area.** For skin to closure bondline at leading edge, do equipment Settings/Standardization/Setup for model 80 Fokker Bond Tester (WP008 14) except as below:

- a. Set (bond tester) front face settings:

DSP.....	ACTIVATED
MODE.....	M
S (SWEEP RATE).....	1
R (SWEEP RANGE)....	5
F (FREQUENCY BAND).....	5

**NOTE**

It is important to use correct amount of couplant. Not enough couplant will give incorrect response.

- b. Apply couplant to skin to core area shown in figure 14.
- c. Position probe on skin to core area.
- d. Use FREQ. FINE and GAIN to get unbond A-scale response of  $0 \pm 1$  KHz and B-scale response of approximately 100. See figure 14, display 1.
- e. Reposition probe over known nearby good bond area and observe good bond response. For this procedure, typical good bond response has A-scale display between -20 and -40 KHz and B-scale display of 122, B-scale maximum, see figure 14, display 2.

**23. Inspection Procedures For Skin To Closure Area.** For skin to closure bondline at leading edge, do Inspection Procedure (WP008 14) except as below:

- a. Outline inspection area with aircraft marking pencil, see figure 13.
- b. Apply couplant to inspection area. Use distilled water if leading edge of skin is open to edge.
- c. Position probe on upper or lower surface of inspection area.

## NOTE

When abnormal amount of fairing material or metal strap doubler has been used in skin to closure area, delete inspection in this area. Abnormal amount of fairing material is indicated by A-scale air response even with correct coupling.

d. Inspect skin to closure bondline by monitoring A-scale numeric display. Maintain good coupling because air responses will appear similar to unbond response. Use scan index of 3/16 inch or half probe diameter.

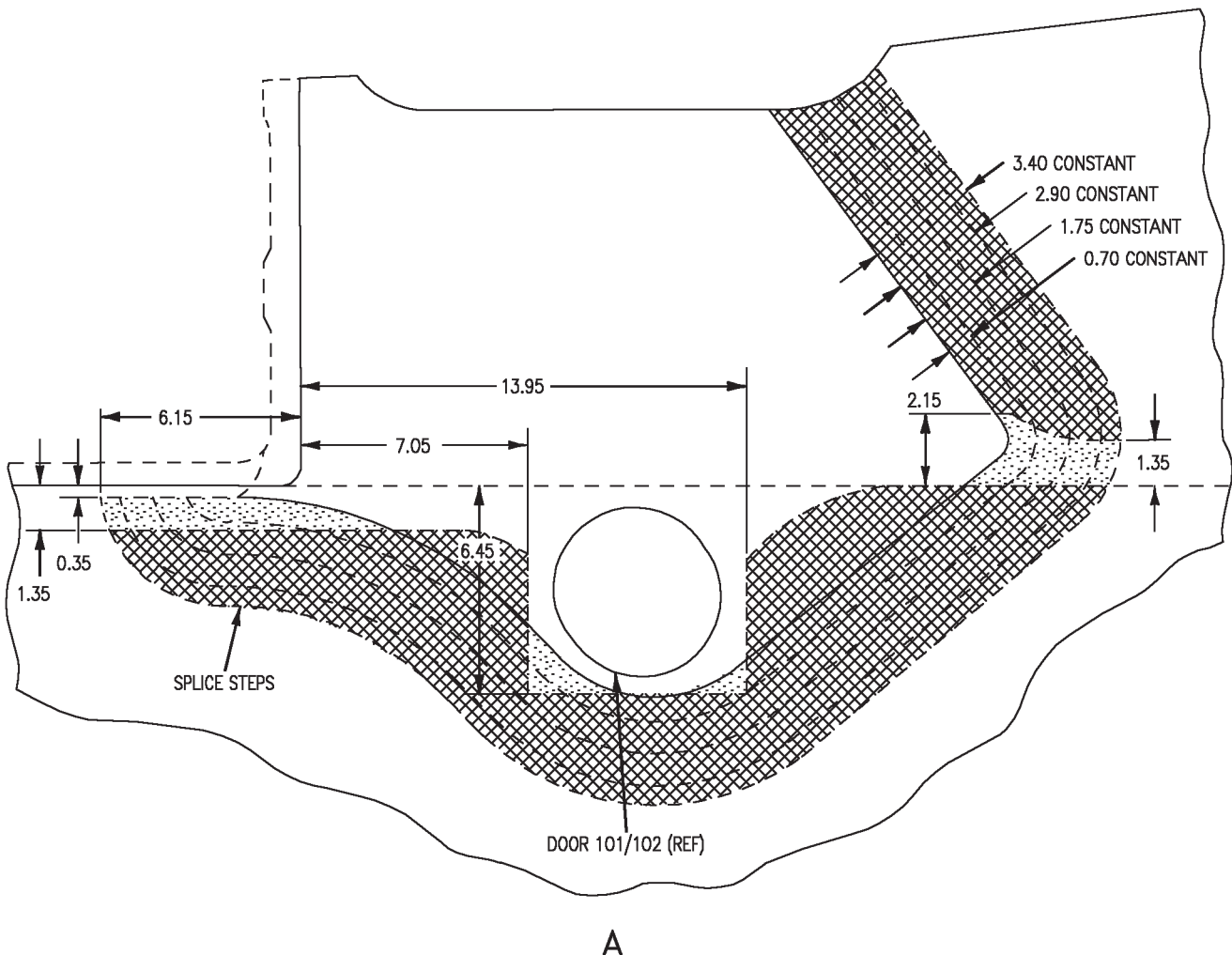
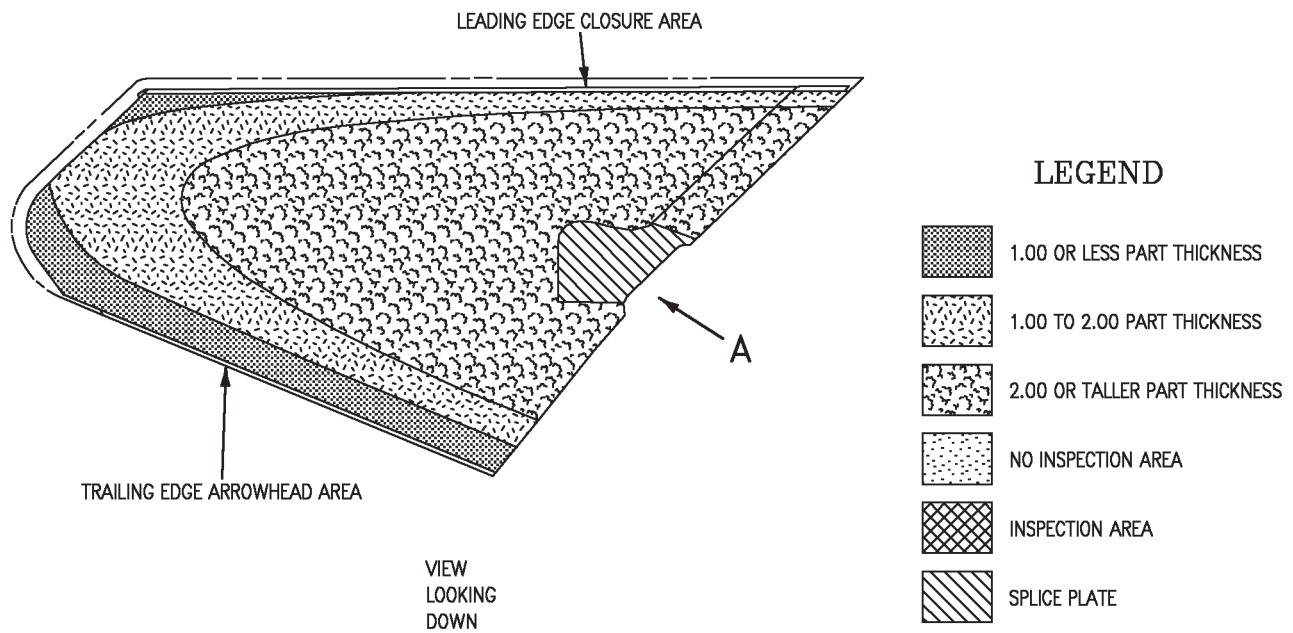
e. Areas displaying A-scale response of -5 KHz through 5 KHz indicate unbond.

f. Mark all unbond response area with aircraft marking pencil.

## WARNING

Dry cleaning solvent and methyl isobutyl ketone are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

**24. POST INSPECTION CLEANING AND CORROSION CONTROL.** Clean inspection area with solvent moistened cloth to make sure inspection area(s) is free of contamination or foreign material.



**Figure 1. Horizontal Stabilator Inspection Areas and Internal Structure (Sheet 1)**

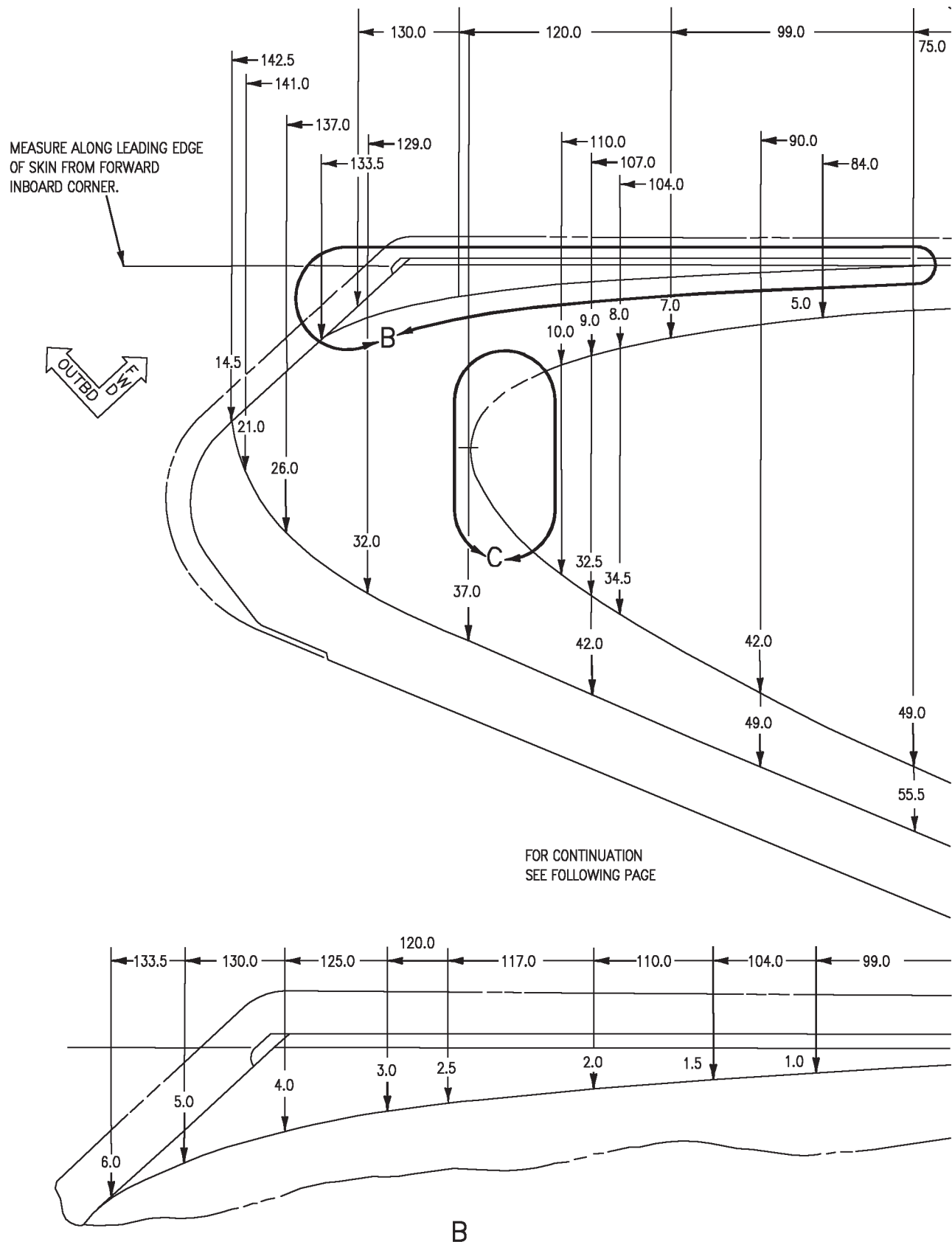


Figure 1. Horizontal Stabilator Inspection Areas and Internal Structure (Sheet 2)

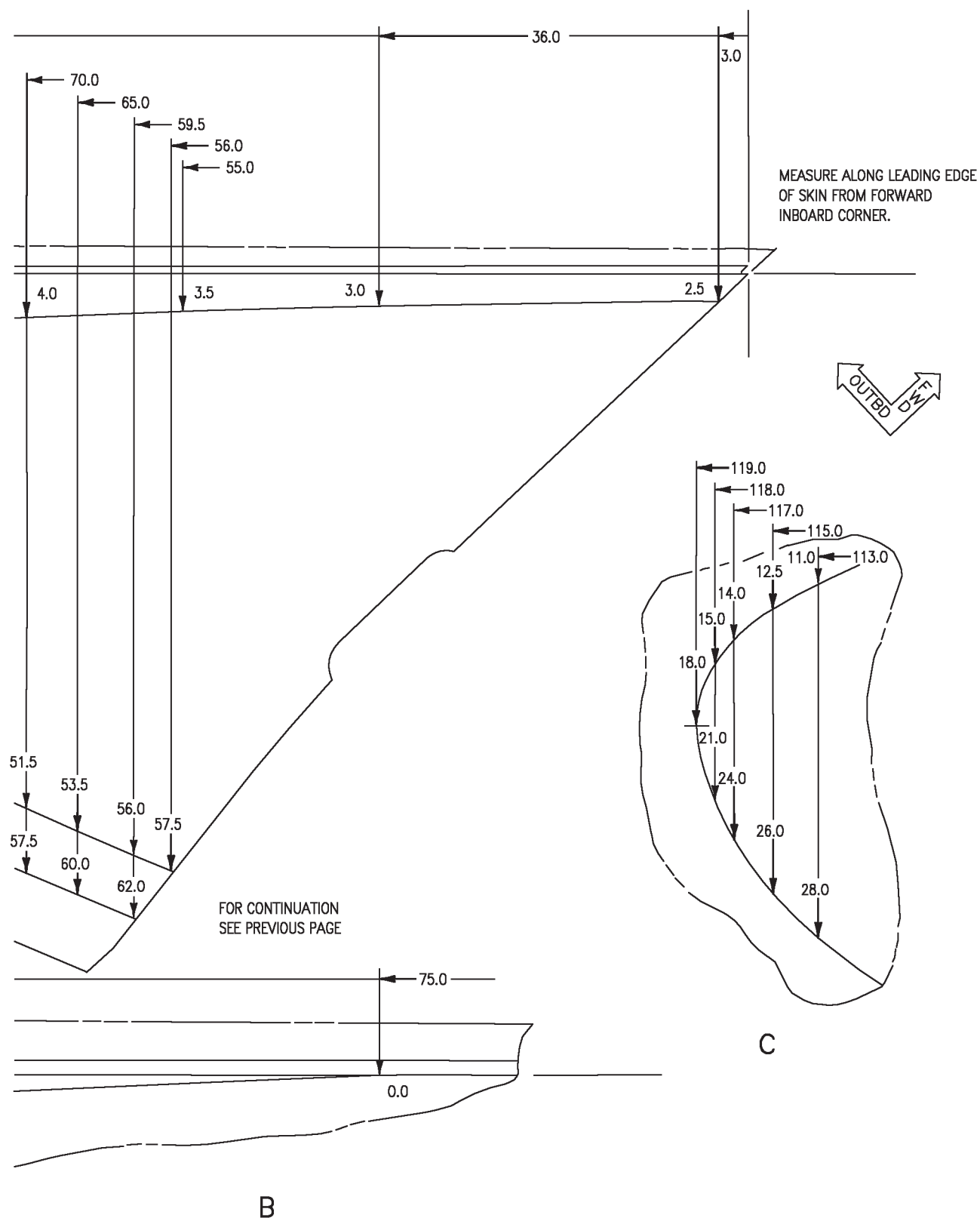


Figure 1. Horizontal Stabilator Inspection Areas and Internal Structure (Sheet 3)

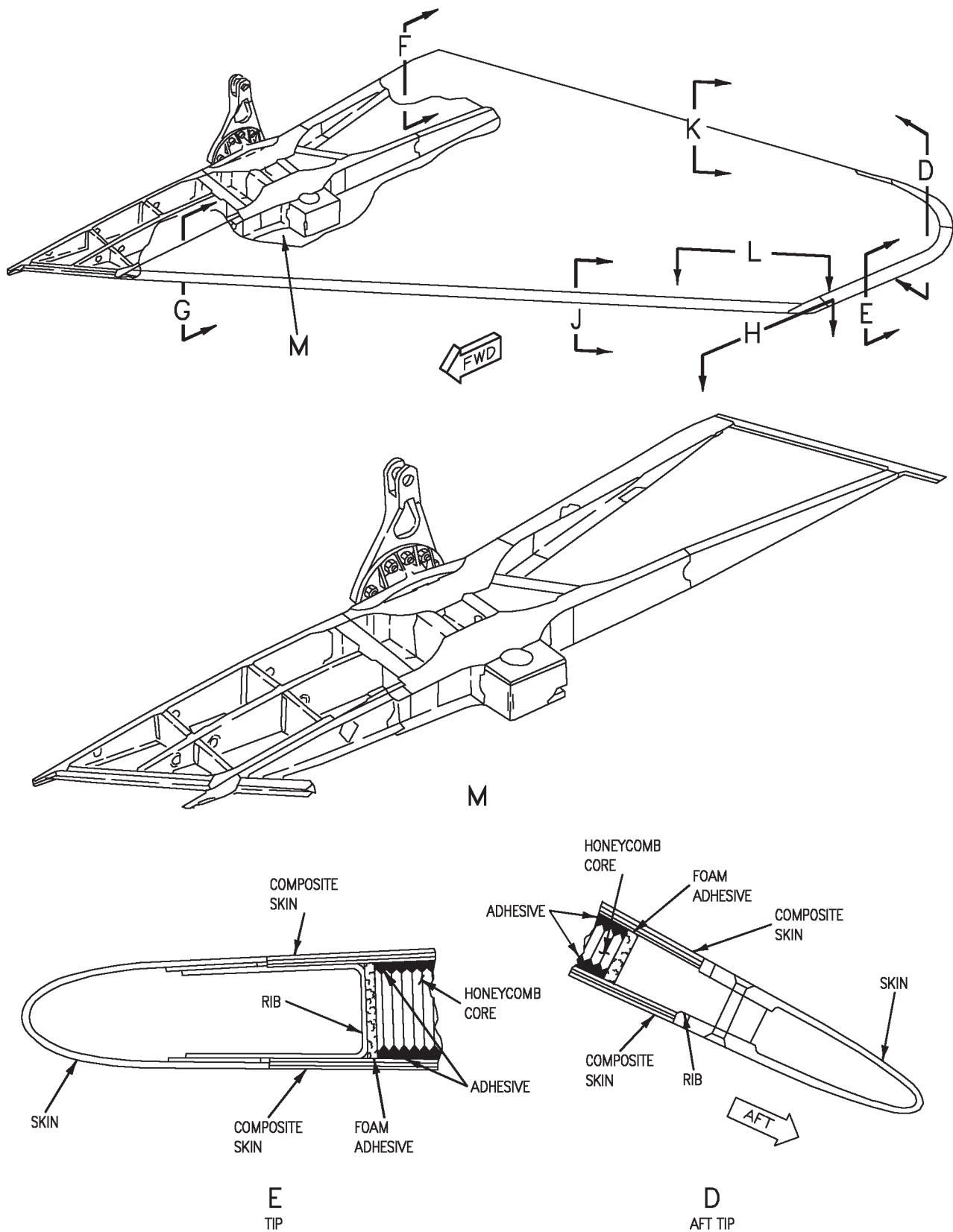


Figure 1. Horizontal Stabilator Inspection Areas and Internal Structure (Sheet 4)

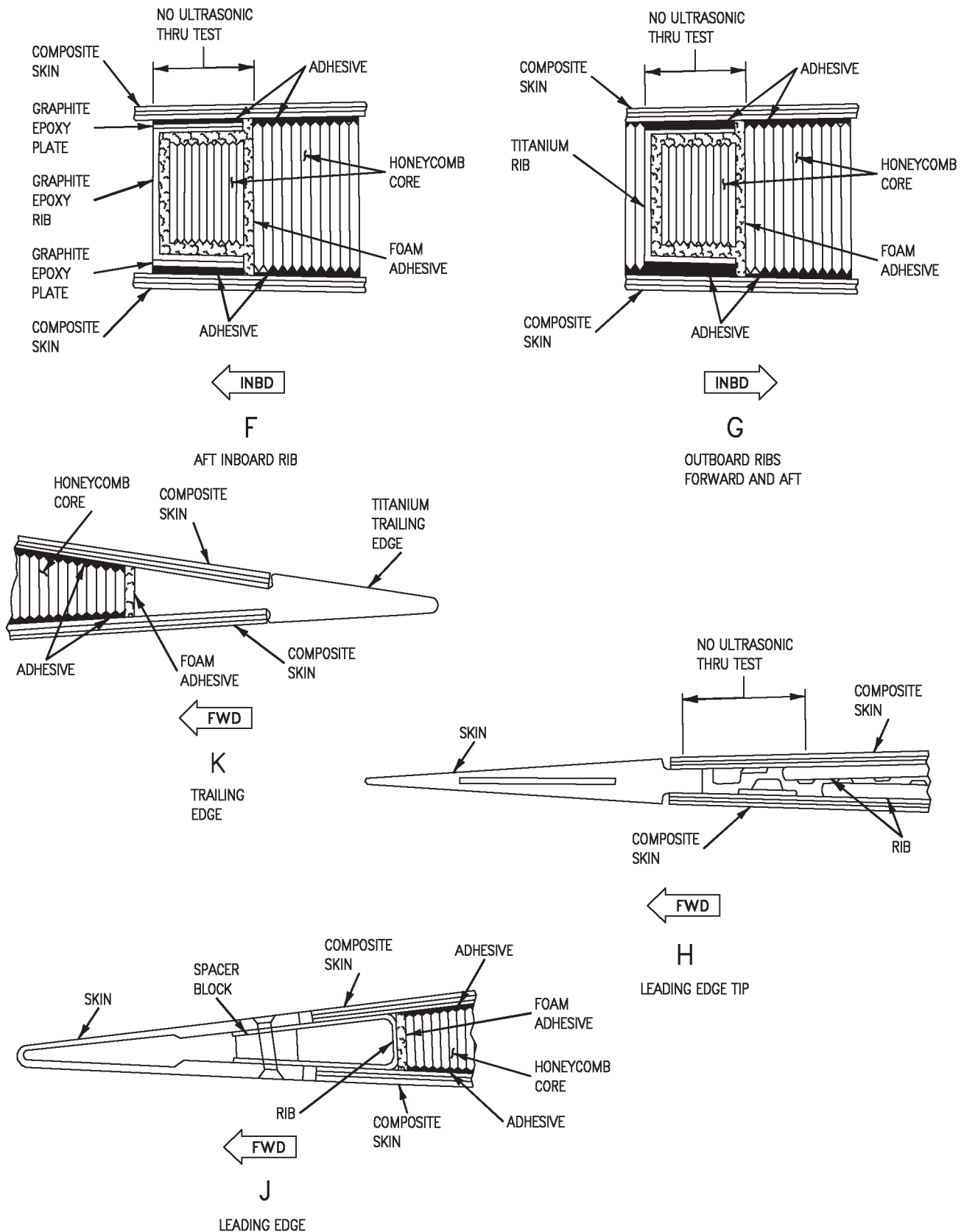


Figure 1. Horizontal Stabilator Inspection Areas and Internal Structure (Sheet 5)



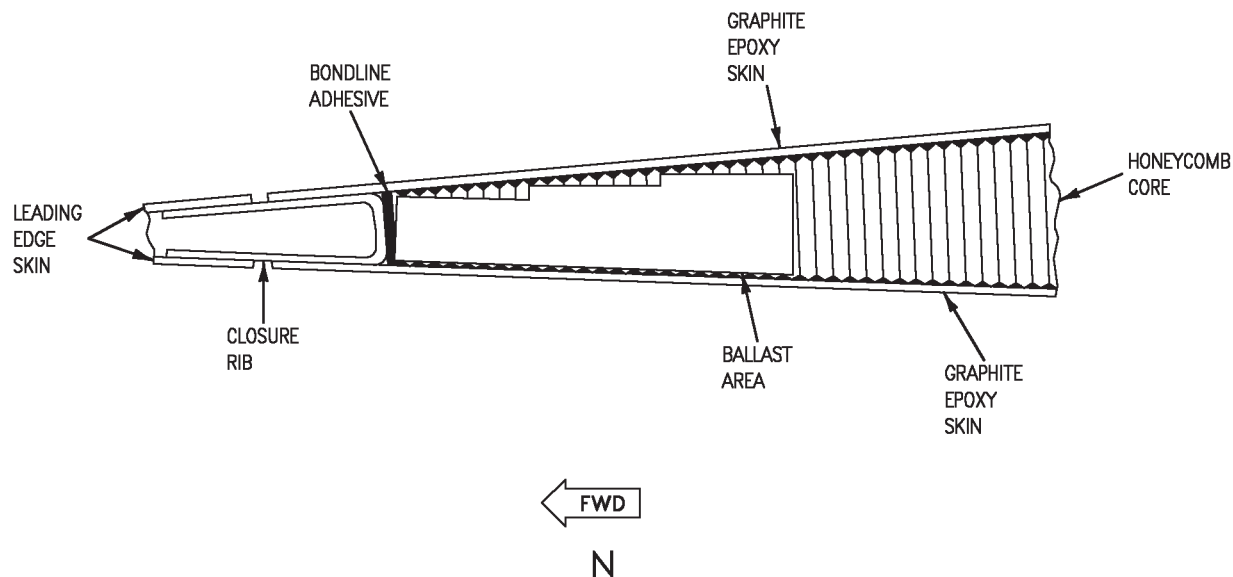
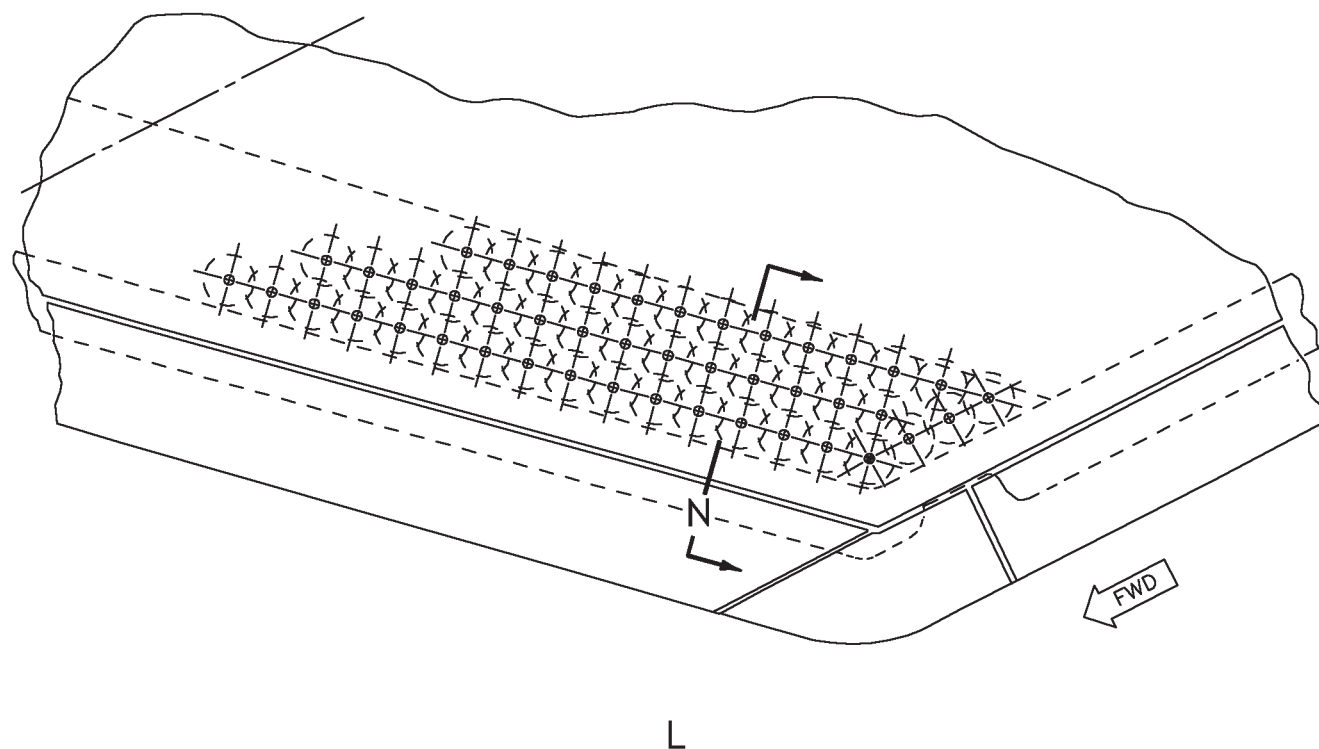


Figure 1. Horizontal Stabilator Inspection Areas and Internal Structure (Sheet 6)

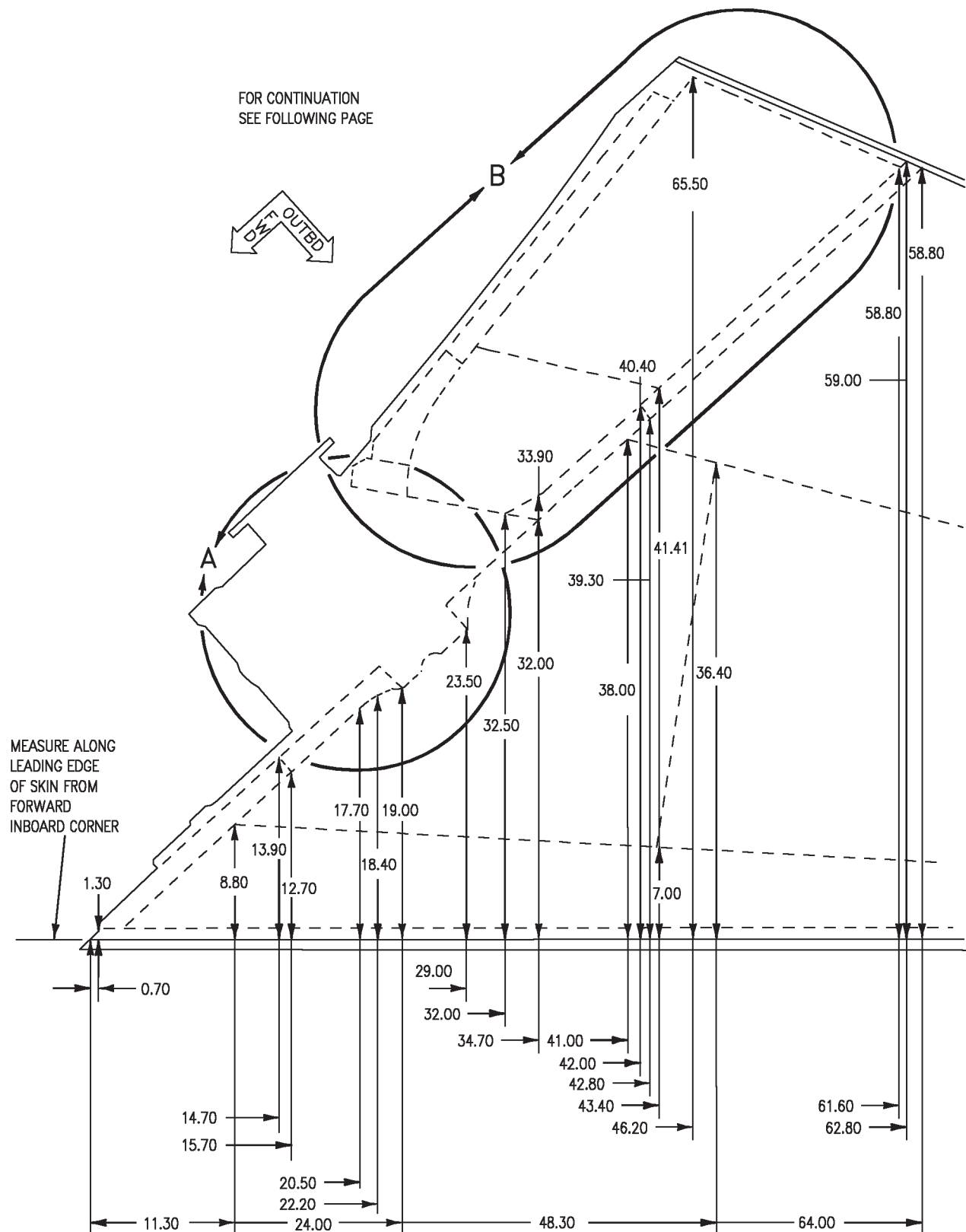


Figure 2. Core Splice Lines (Sheet 1)

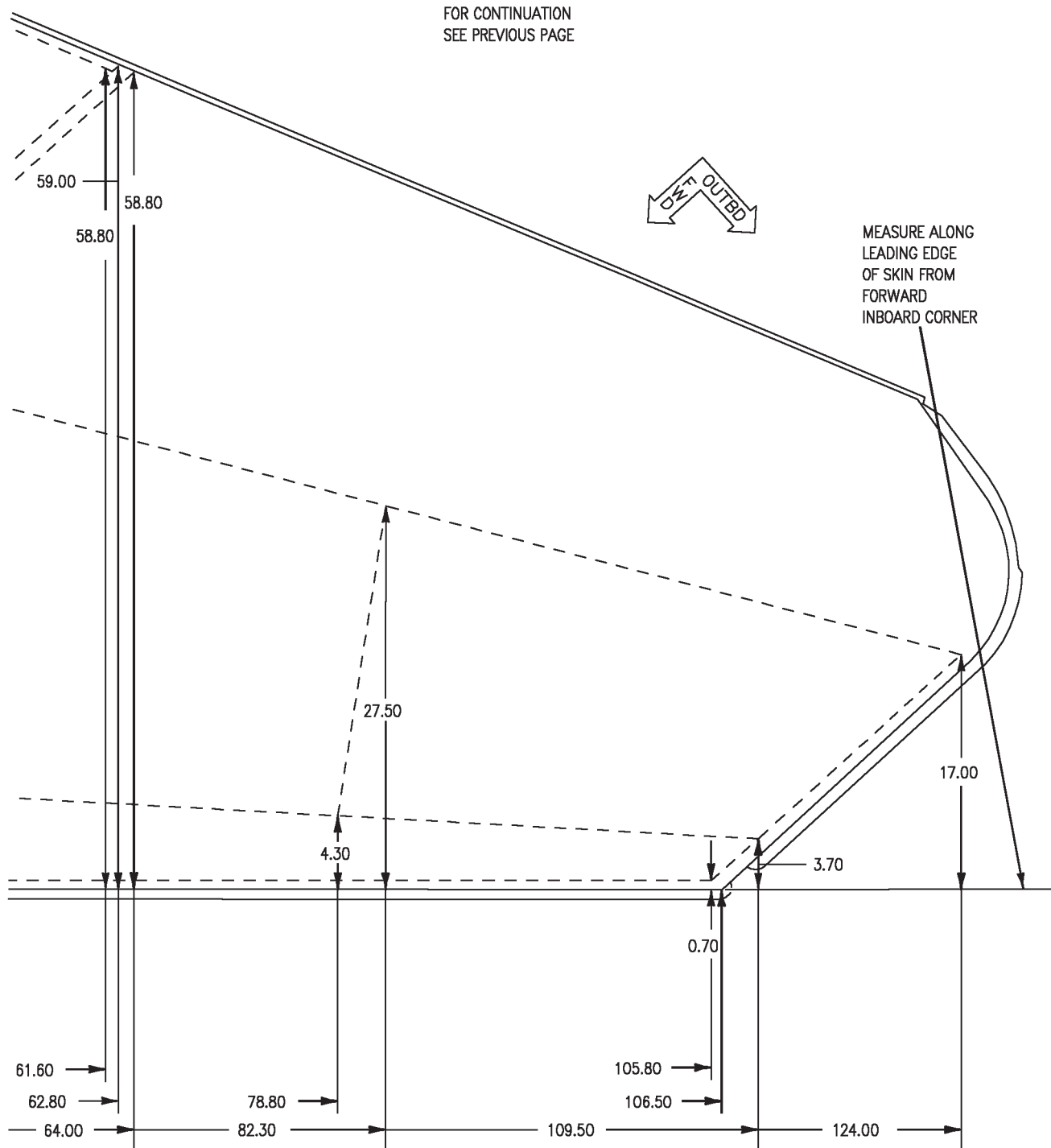


Figure 2. Core Splice Lines (Sheet 2)

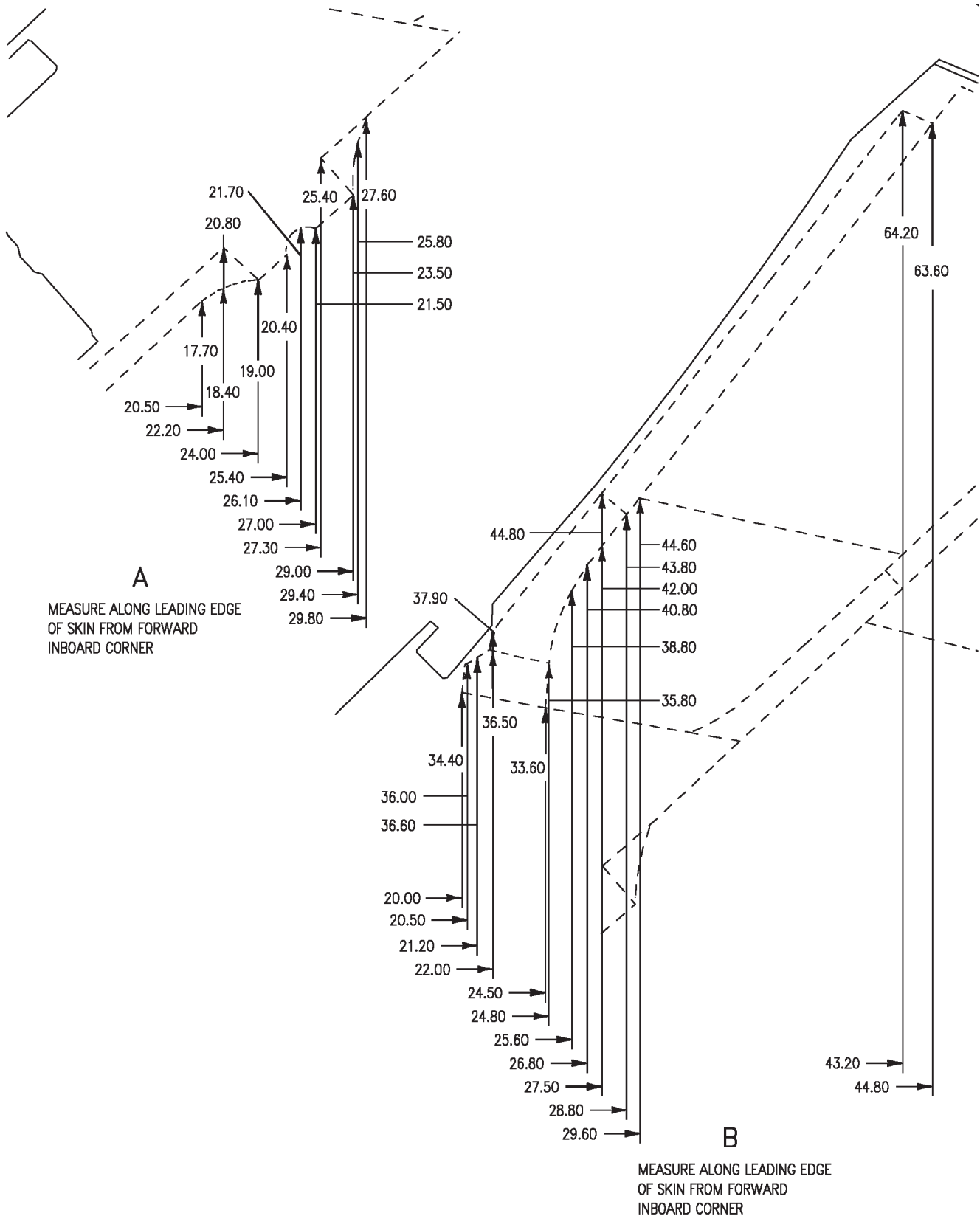
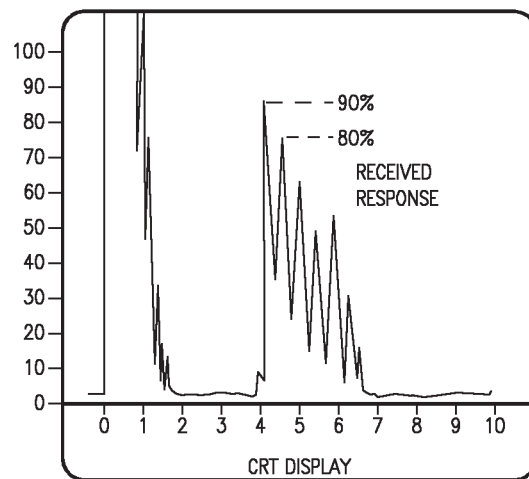
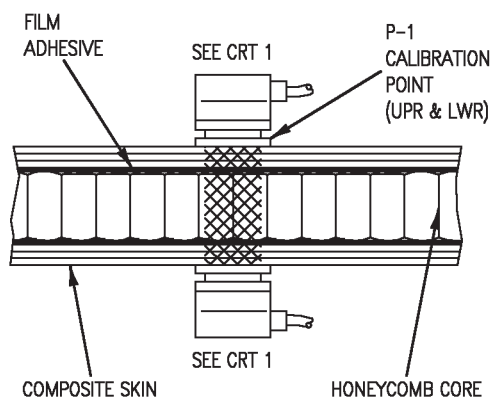
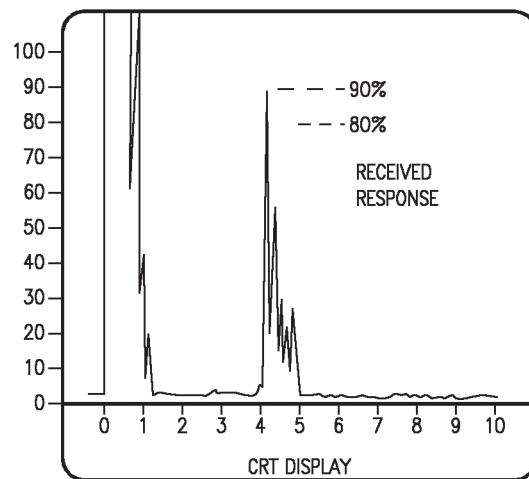
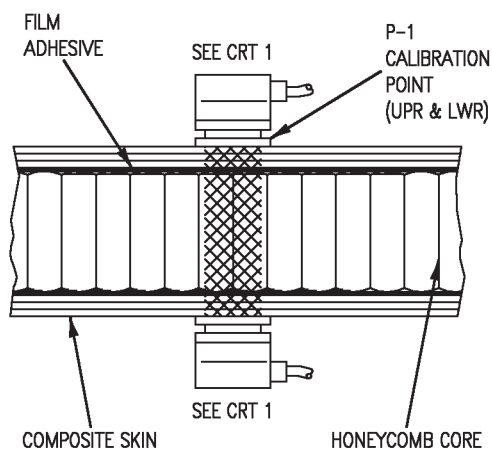


Figure 2. Core Splice Lines (Sheet 3)



CRT 1

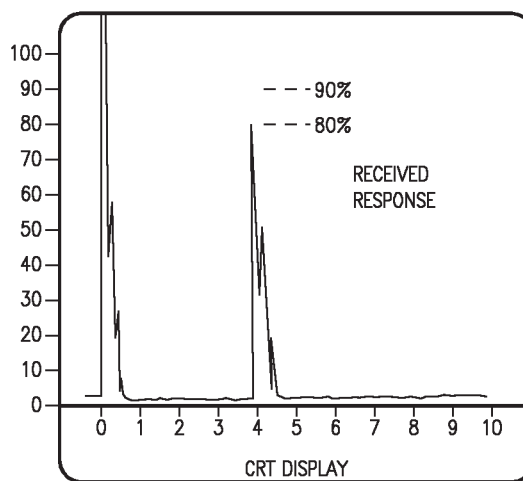
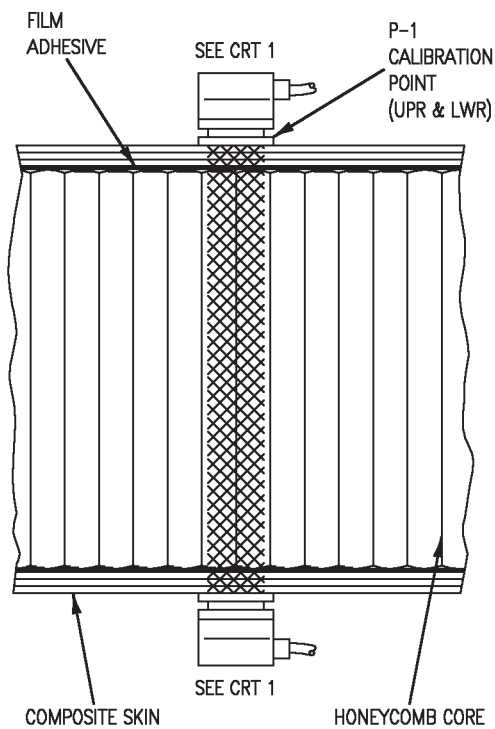
LEADING EDGE OF RECEIVED RESPONSE  
LOCATED AT 4 ON THE HORIZONTAL BASELINE.



CRT 1

LEADING EDGE OF RECEIVED RESPONSE  
LOCATED AT 4 ON THE HORIZONTAL BASELINE.

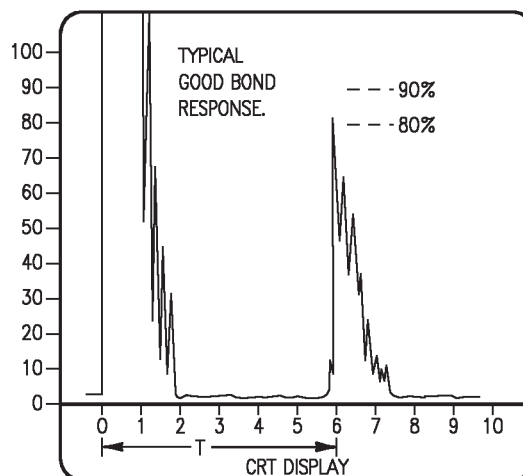
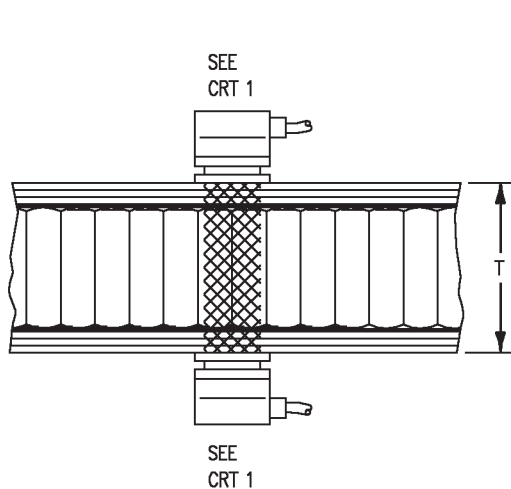
Figure 4. Standardization on 1 Inch Tall Honeycomb Core Reference Standard



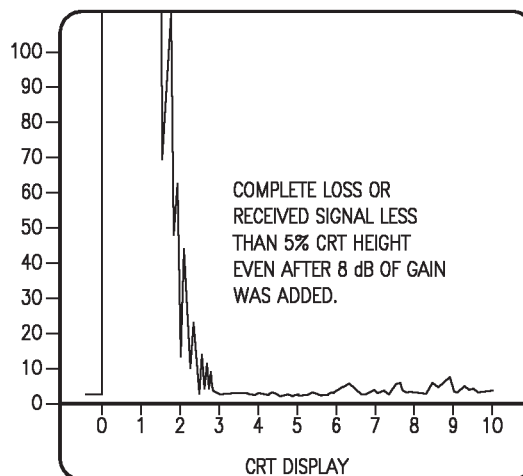
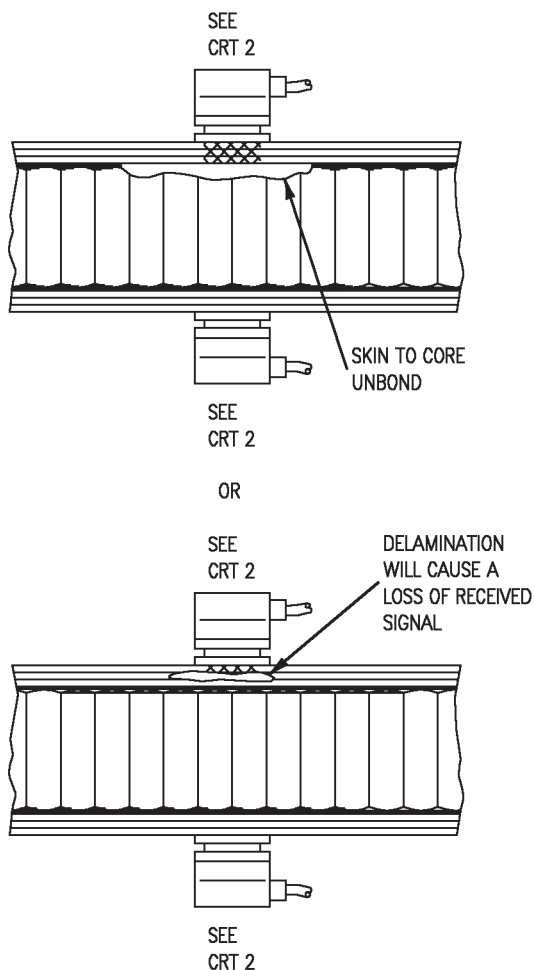
CRT 1

LEADING EDGE OF RECEIVED RESPONSE  
LOCATED AT 4 ON THE HORIZONTAL BASELINE.

Figure 5. Standardization on 3 Inch Tall Honeycomb Core Reference Standard



CRT 1

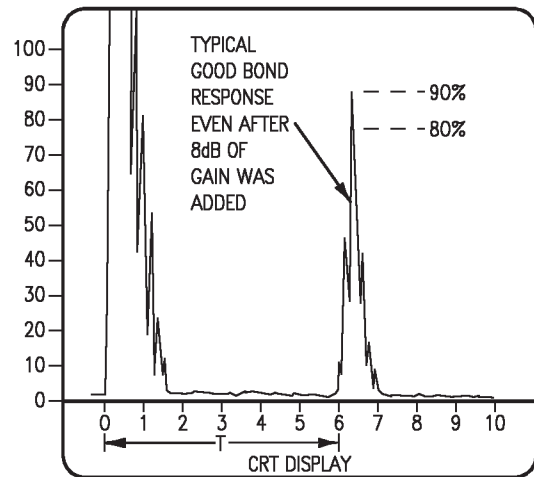
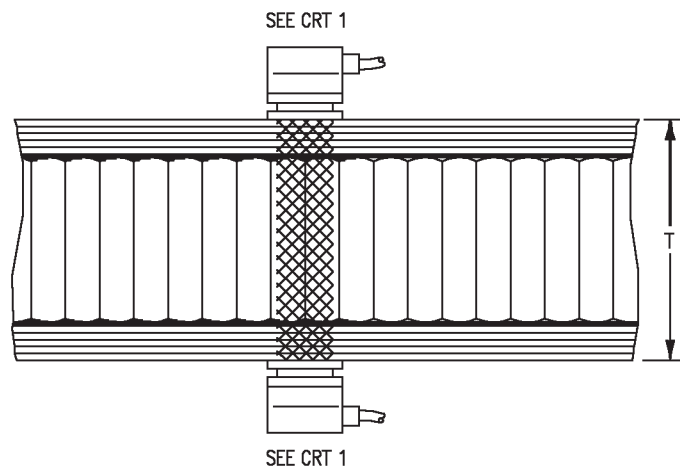


CRT 2

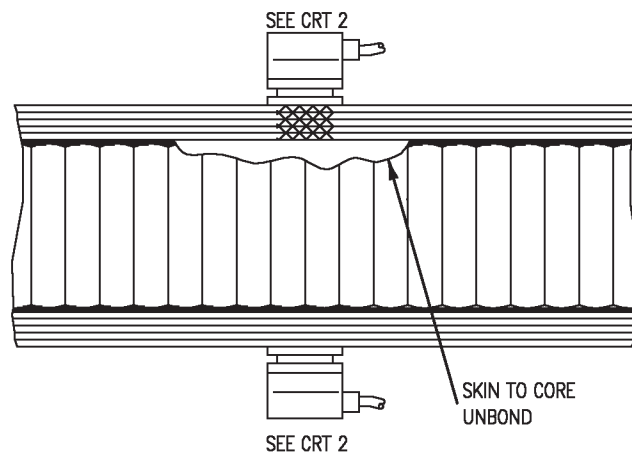
TYPICAL SKIN TO CORE AREA  
UNBOND RESPONSE.

**Figure 6. Honeycomb Core Inspection Response in Area Where Core Height is 1 Inch or Less**

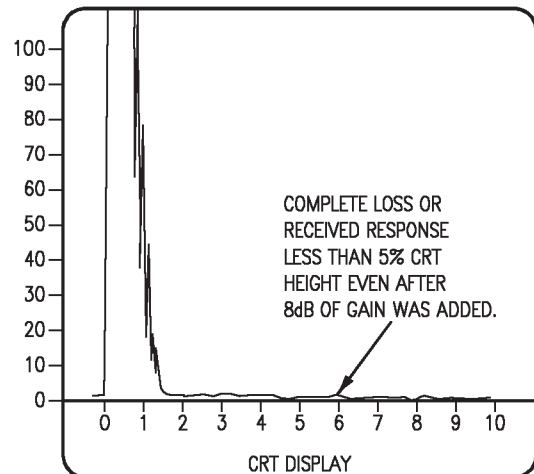
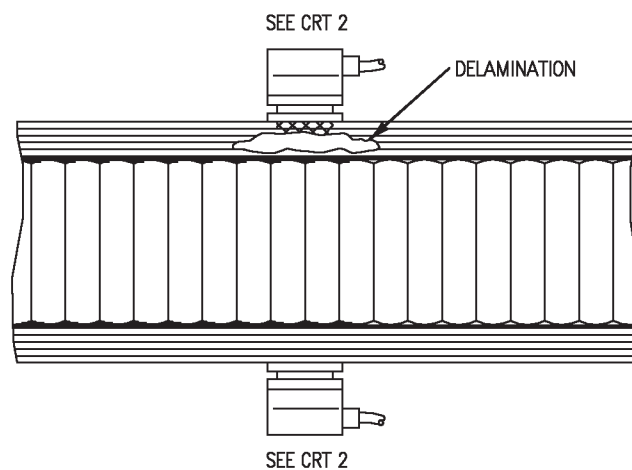




CRT 1



OR



CRT 2

TYPICAL SKIN TO CORE AREA UNBOND RESPONSE

Figure 7. Inspection Procedures for 1 to 2 Inches Tall Honeycomb Core Area

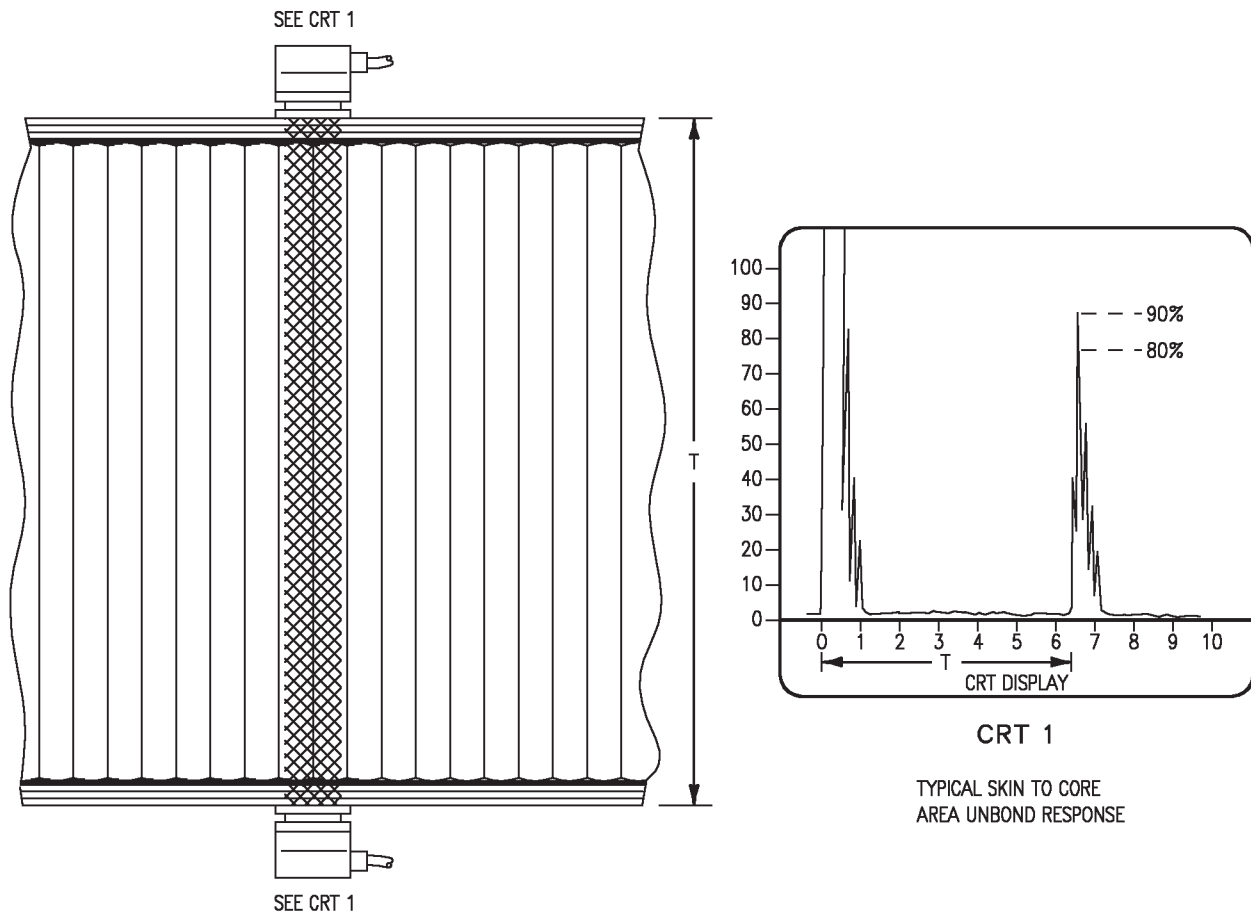
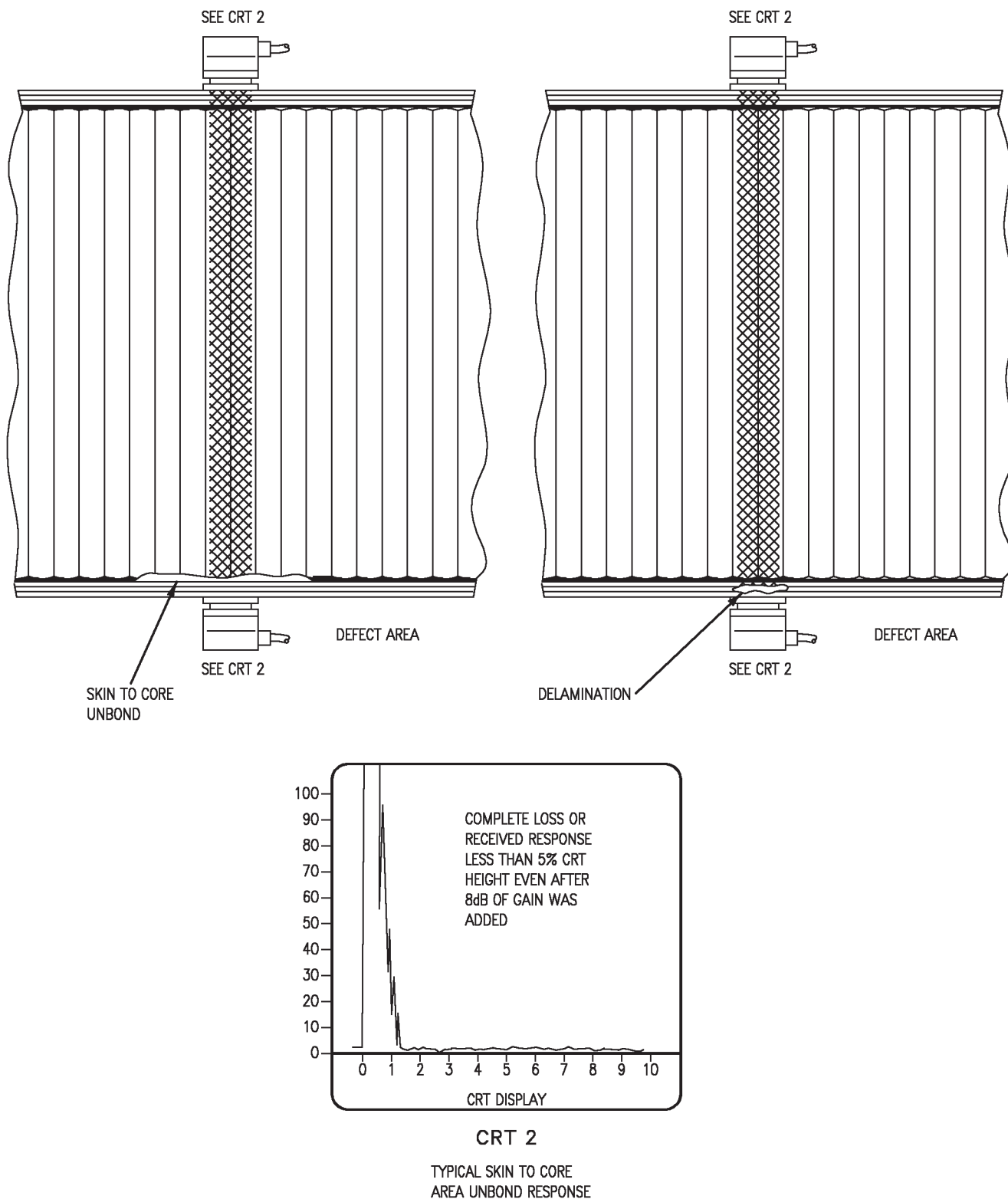
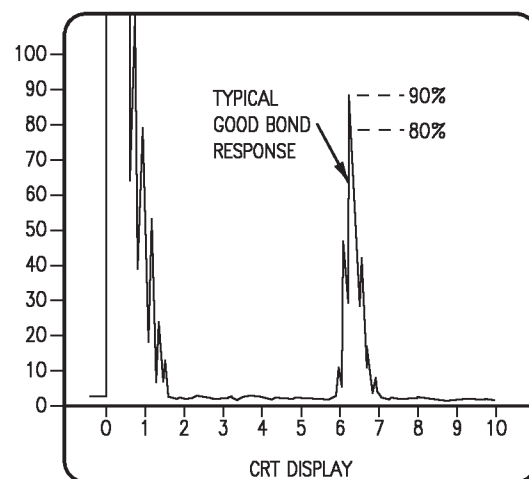
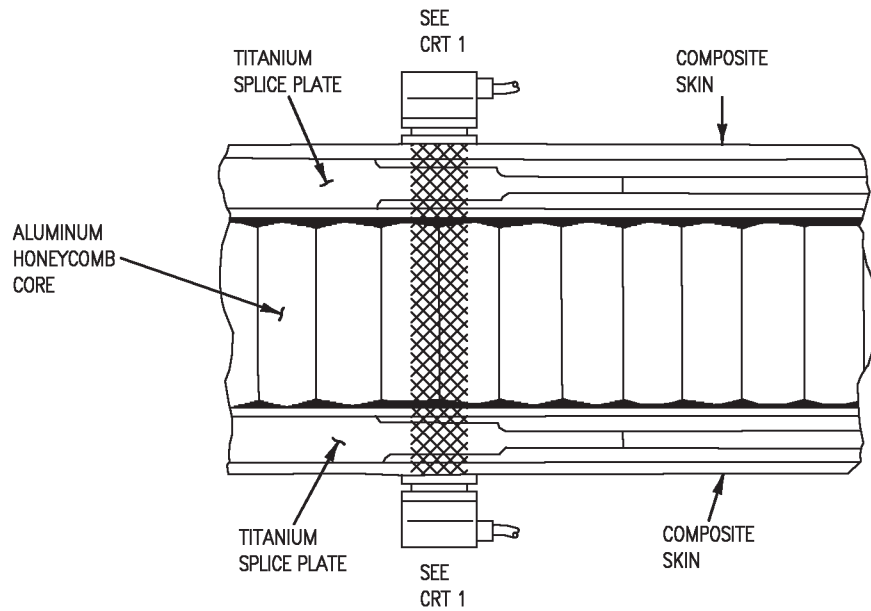


Figure 8. Inspection Procedures for 2 Inches or Taller, Honeycomb Core Areas  
(Sheet 1)

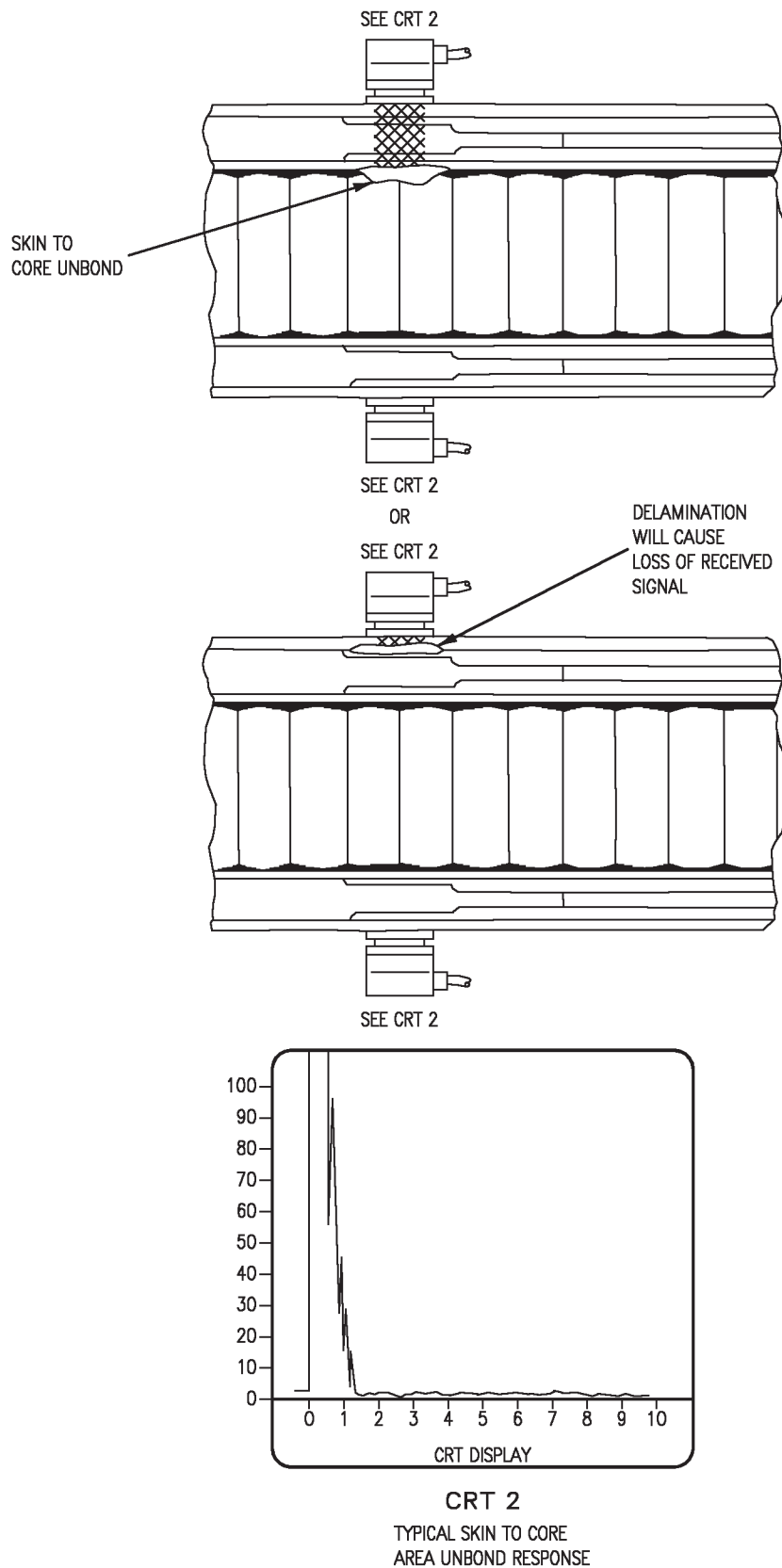


**Figure 9. Inspection Procedures for 2 Inches or Taller, Honeycomb Core Areas (Sheet 2)**

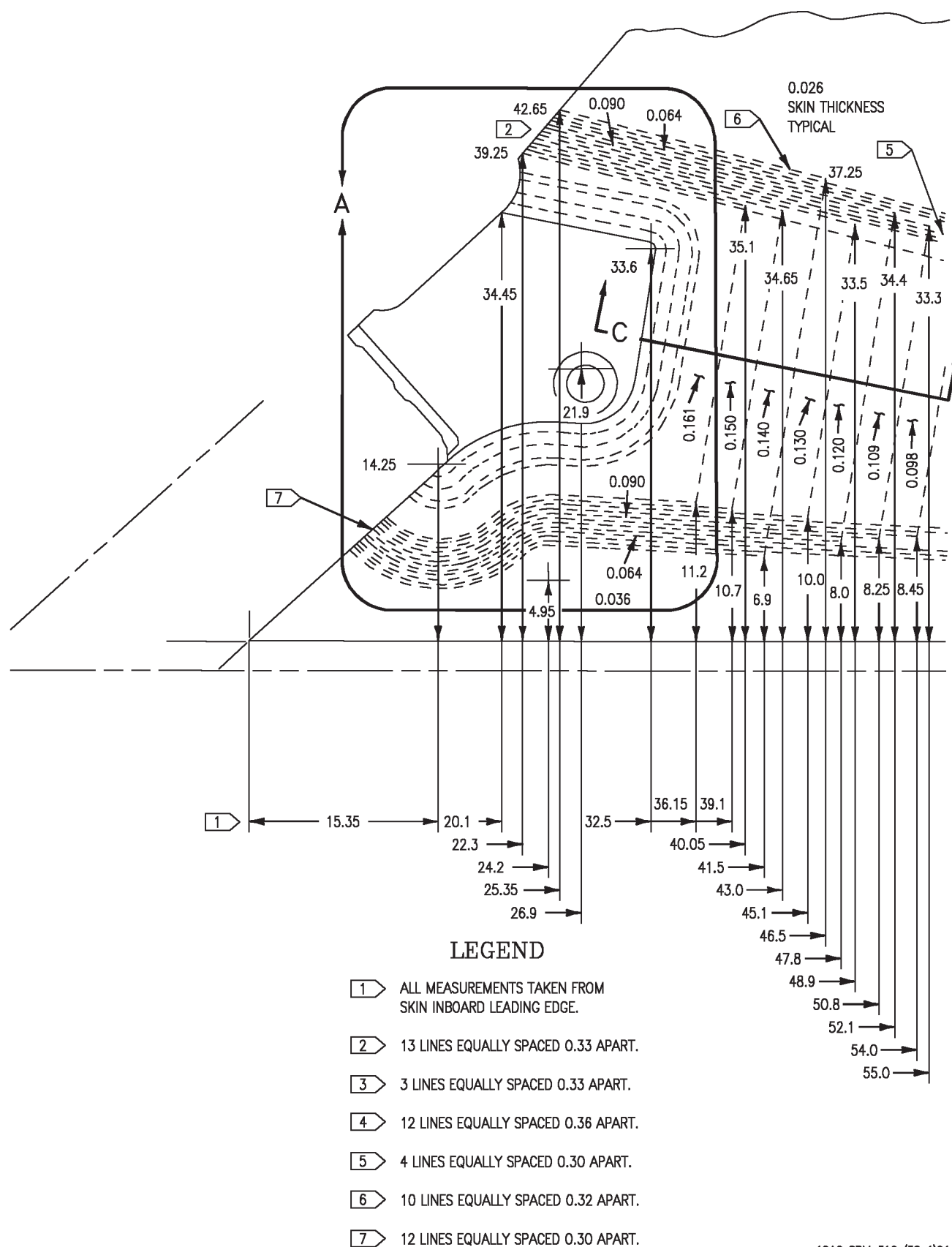


CRT 1

Figure 9. Honeycomb Core Area Inspection at Splice Plate (Sheet 1)



**Figure 9. Honeycomb Core Area Inspection at Splice Plate (Sheet 2)**



### Figure 10. Composite Skin Thickness (Sheet 1)

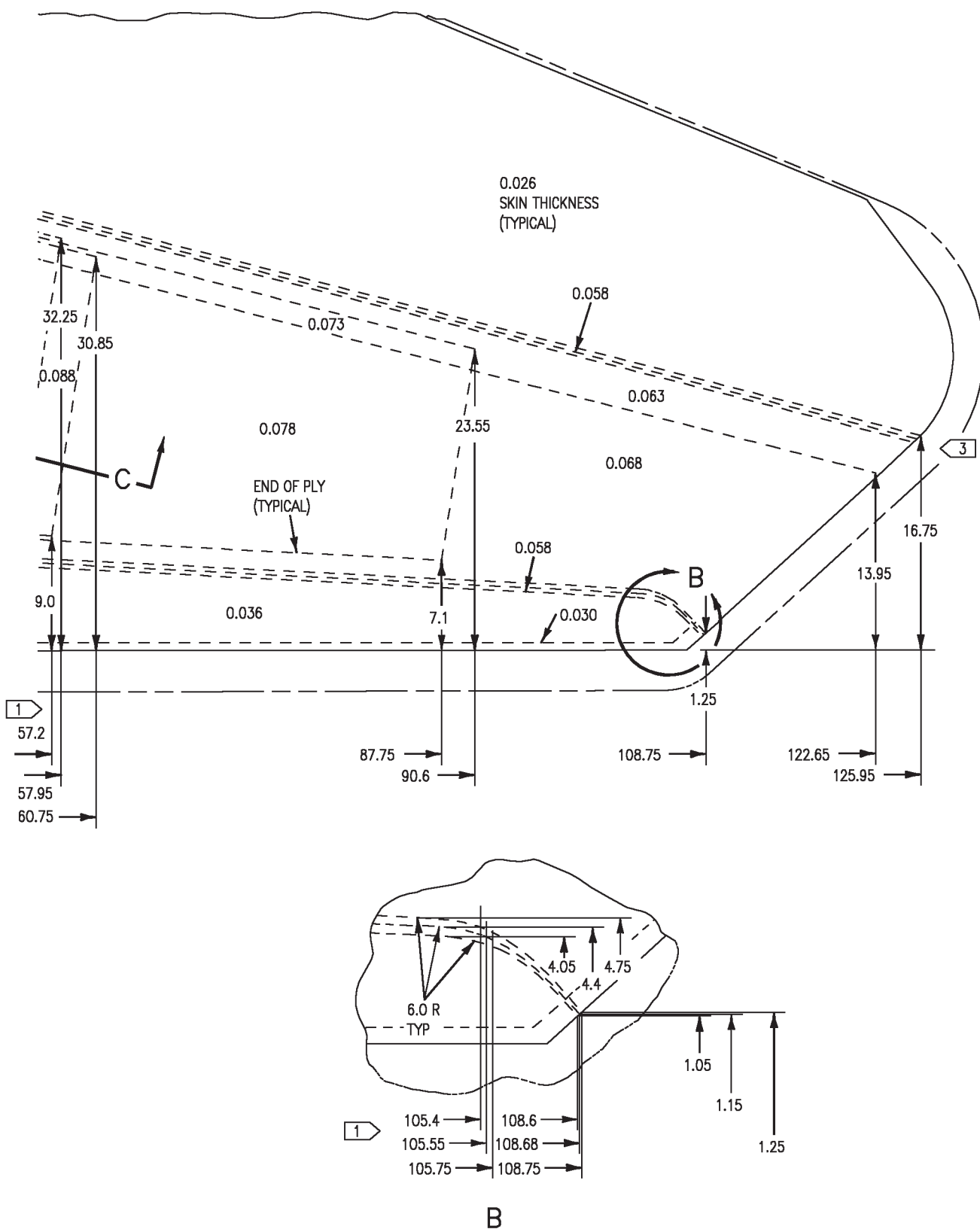


Figure 10. Composite Skin Thickness (Sheet 2)

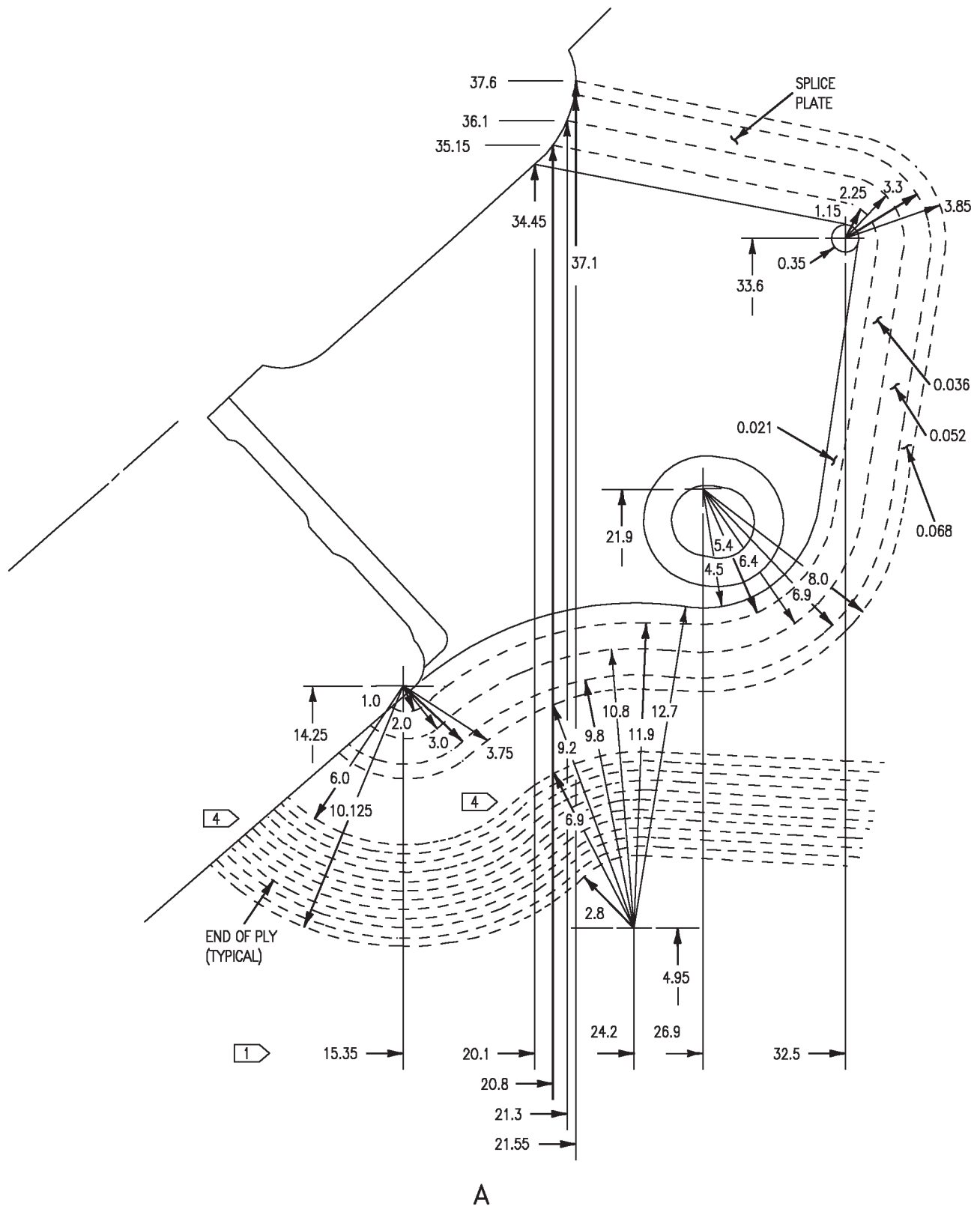
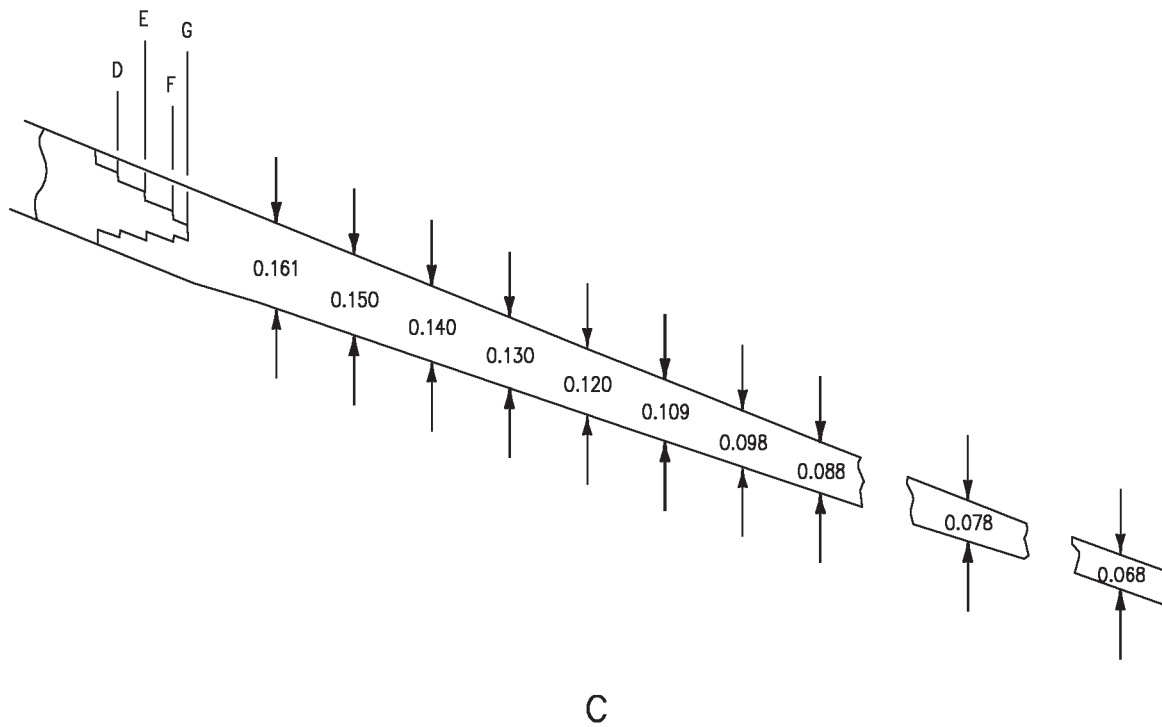


Figure 10. Composite Skin Thickness (Sheet 3)

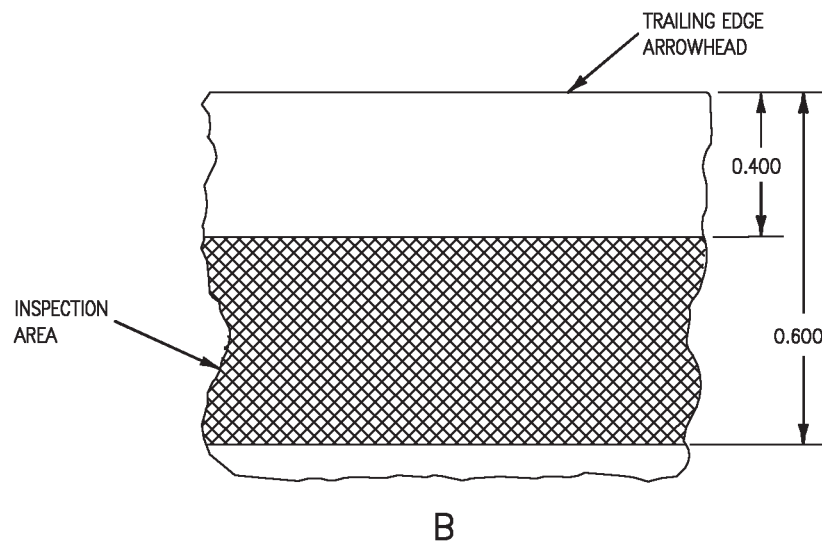
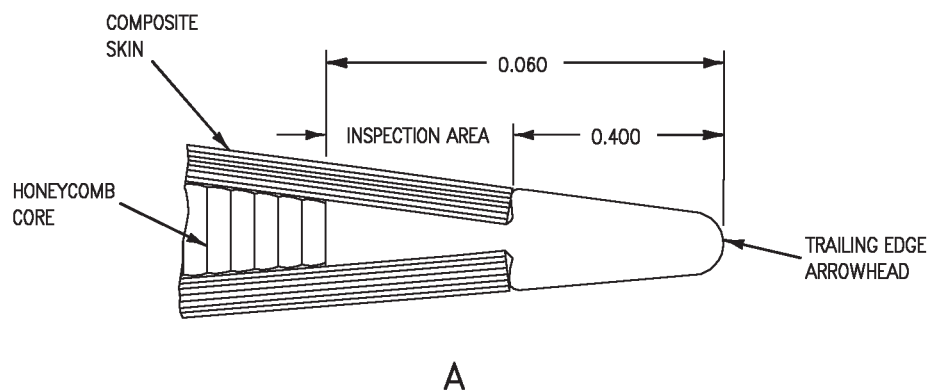
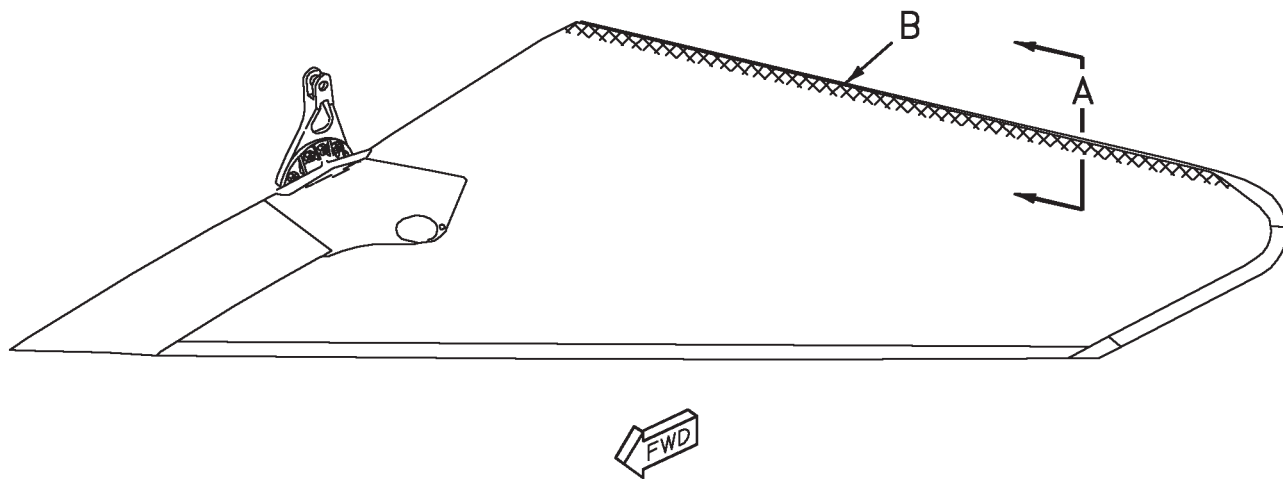




## LEGEND

D - 0.0208  
 E - 0.0364  
 F - 0.0520  
 G - 0.0676

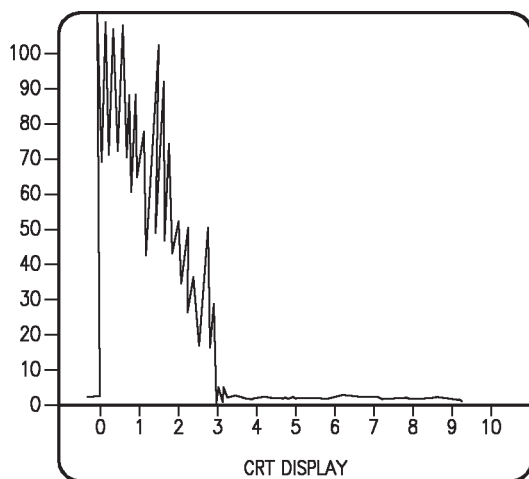
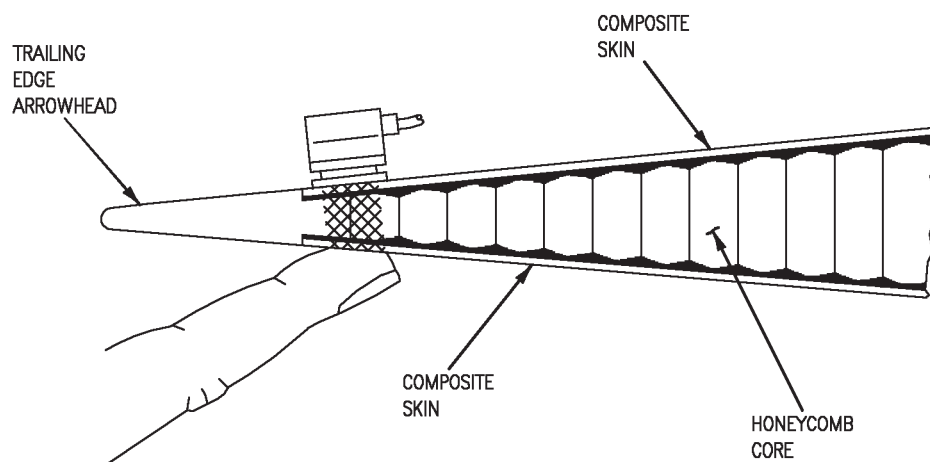
Figure 10. Composite Skin Thickness (Sheet 4)



LEGEND

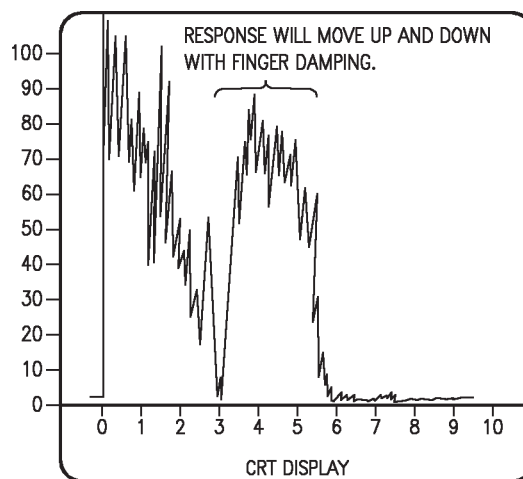


Figure 11. Trailing Edge Inspection Area (Sheet 1)



CRT 1

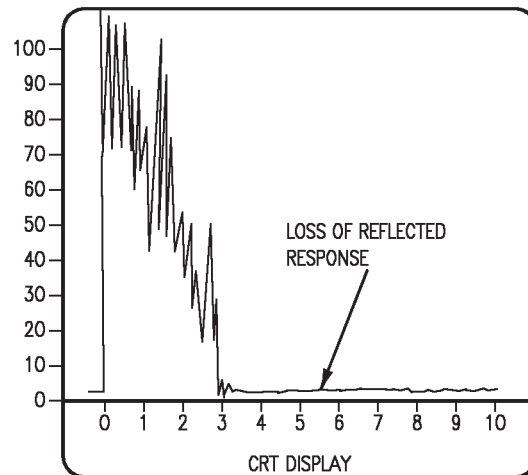
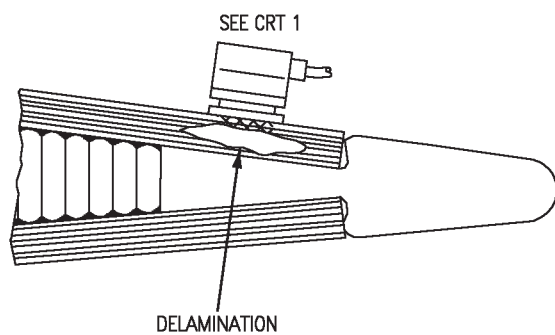
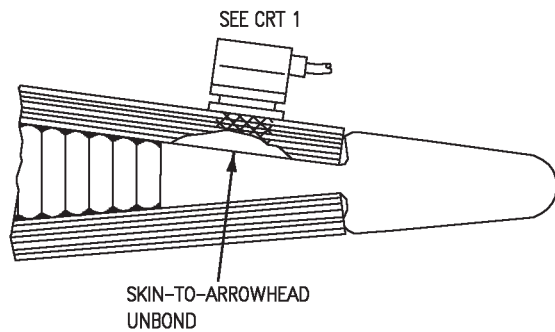
RESPONSE WITH SEARCH UNIT OFF PART



CRT 2

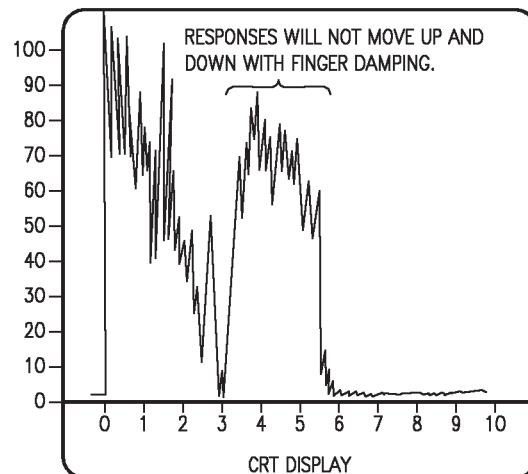
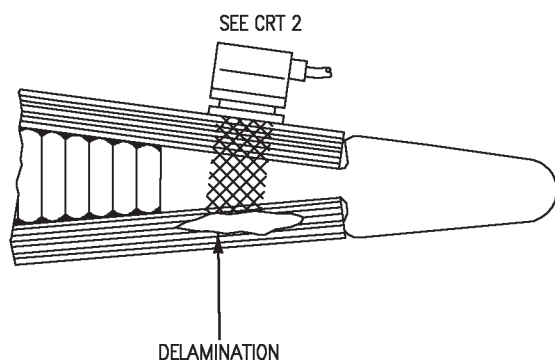
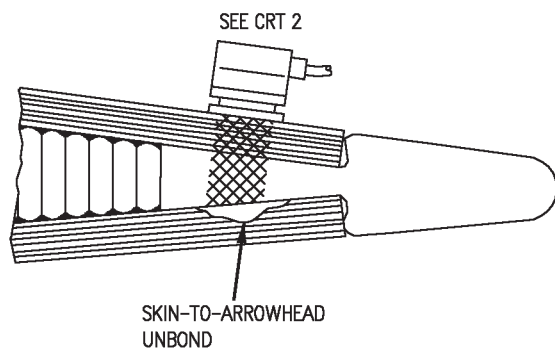
RESPONSE WITH SEARCH UNIT ON PART

Figure 11. Trailing Edge Inspection Area (Sheet 2)



**CRT 1**

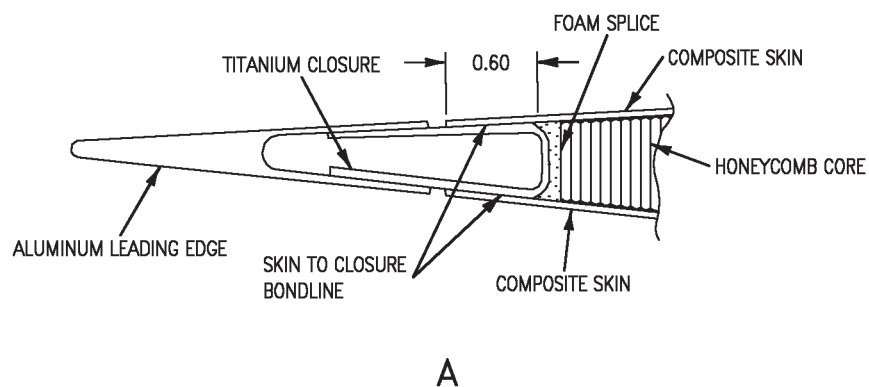
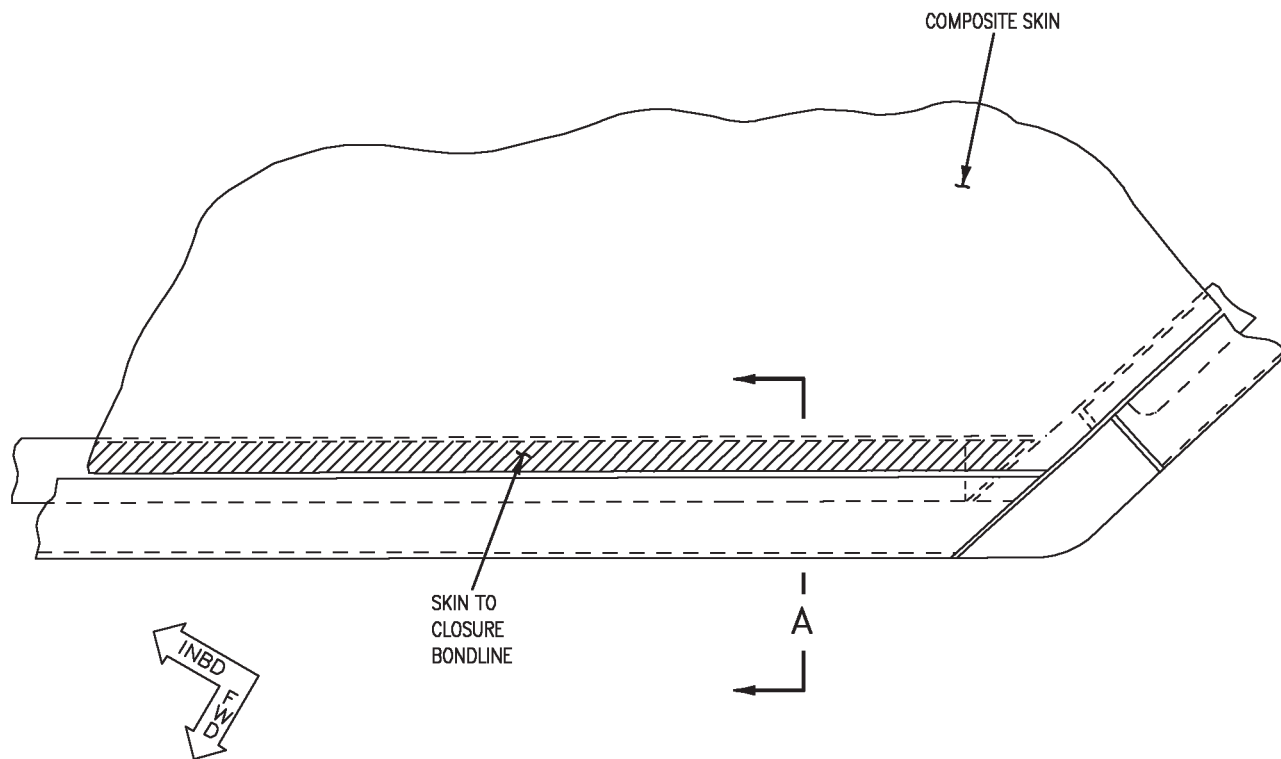
UNBOND OR DELAMINATION  
ON SEARCH UNIT SIDE.



**CRT 2**

UNBOND OR DELAMINATION  
ON SIDE OPPOSITE SEARCH UNIT.

**Figure 12. Ultrasonic Responses in Trailing Edge Arrowhead Area**



## LEGEND



Figure 13. Horizontal Stabilizer Leading Edge Closure (Sheet 1)

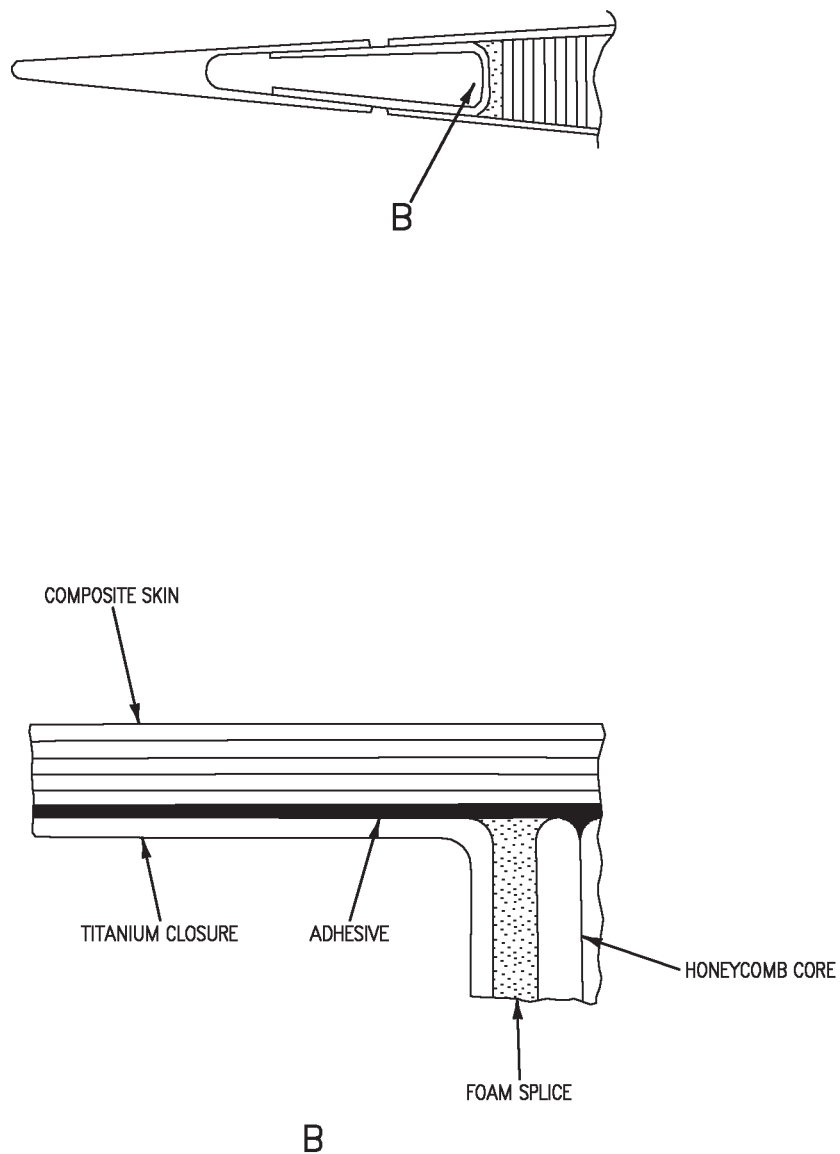
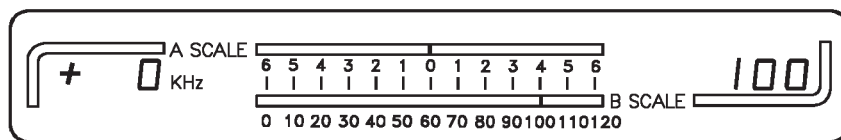
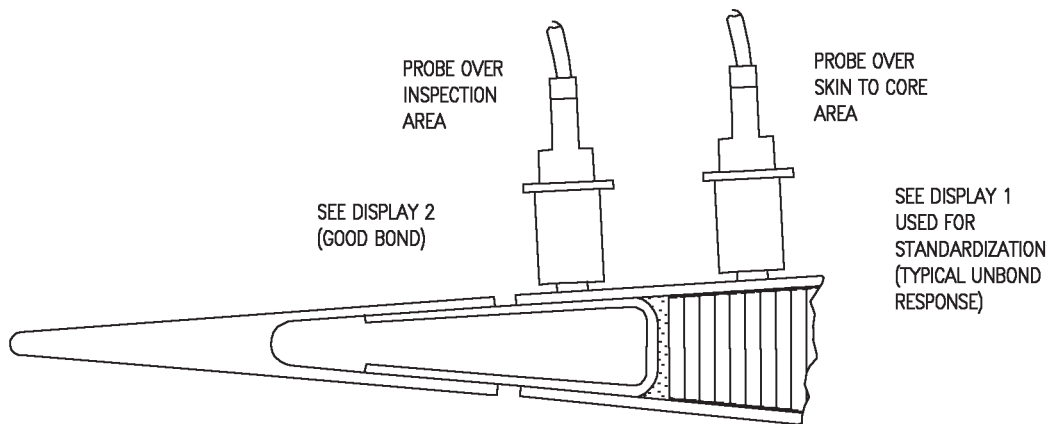
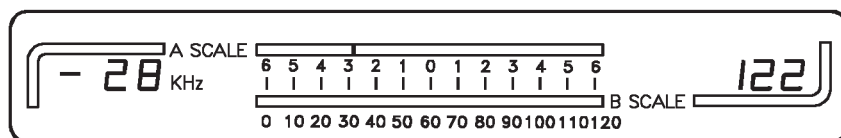


Figure 13. Horizontal Stabilizer Leading Edge Closure (Sheet 2)

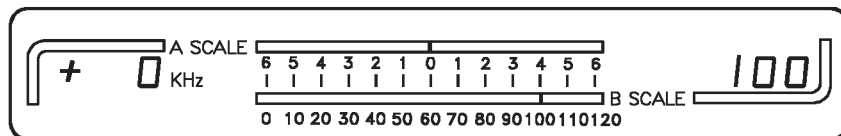
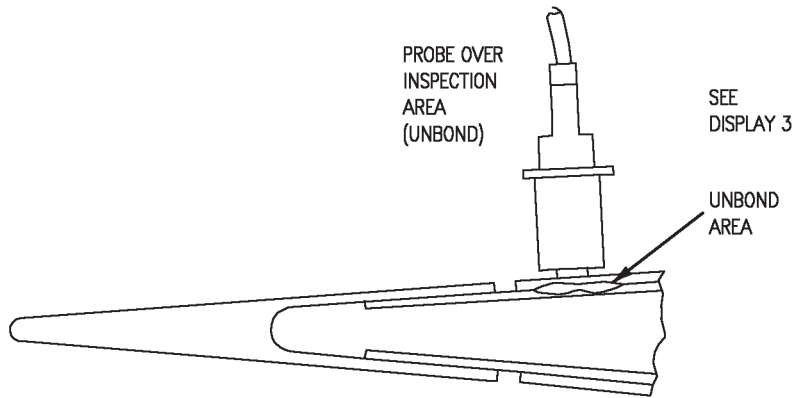


DISPLAY 1  
STANDARDIZATION  
RESPONSE



DISPLAY 2  
TYPICAL RESPONSE FROM  
GOOD BOND AREA

Figure 14. Good Bond/Unbond Responses (Sheet 1)



## DISPLAY 3

TYPICAL RESPONSE  
FROM TITANIUM  
CLOSURE UNBOND

Figure 14. Good Bond/Unbond Responses (Sheet 2)



## INTERMEDIATE MAINTENANCE

## NONDESTRUCTIVE INSPECTION

## HORIZONTAL STABILATOR

## BALLAST AREA

## Reference Material

Plane Captain Manual .....	A1-F18AC-PCM-000
Naval Aviation Maintenance Program .....	OPNAVINST 4790.2
Nondestructive Inspection.....	A1-F18AC-SRM-300
General Information .....	WP003 00
Radiographic Method.....	WP005 00
Ultrasonic Through Transmission Contact Testing, Standardization, and Inspection Procedures for Composite Laminate Skins Bonded to Honey- comb Core .....	WP008 01
Ultrasonic Through Transmission Contact Testing, Standardization, and Inspection Procedures for Composite Laminate and Metallic Skins Bonded to Honeycomb Core .....	WP008 10
Nondestructive Inspection Methods .....	NAVAIR 01-1A-16

## Alphabetical Index

Subject	Page No.
Horizontal Stabilator.....	1
Defects .....	2
Post Inspection Cleaning and Corrosion Control.....	7
Primary Inspection Methods.....	2
Radiographic Method .....	2
Ultrasonic Method Using C-398 Ultrasonic Flaw Detector .....	5
Ultrasonic Method Using MXU-715/E Ultrasonic Flaw Detector .....	5

## Record of Applicable Technical Directives

None

## 1. HORIZONTAL STABILATOR.

2. See figure 1. Horizontal stabilator is bonded honeycomb assembly. Honeycomb core is 0.125, 0.156, 0.188, and 0.250 inch hexagonal cell

aluminum alloy. Skin is graphite epoxy with titanium splice plate in spindle area. Structure enclosing core is titanium spars, ribs, and graphite epoxy rib. Surface finish is epoxy primer and polyurethane coatings.

**NOTE**

Determine configuration of stabilator.

- 74A210001 configuration contains lead ballast at outboard tip and is identified by aluminum skinned structure at inboard leading edge corner.

- 74A210004 configuration contains stainless steel ballast mechanically fastened to leading edge closure and does not contain aluminum skin and substructure at inboard leading edge corner.

Verify configuration before inspection so correct aiming points and film locations are used during X-ray inspection.

3. **DEFECTS.** Inspect for skin to core unbonds and honeycomb core defects. Examples of defects that may develop in bonded assembly are contained in (WP003 00).

4. **PRIMARY INSPECTION METHODS.** There are two primary inspection methods, radiographic and ultrasonic.

5. **Personnel Qualifications.** Personnel doing this nondestructive inspection should be qualified and certified to do radiographic and ultrasonic inspections per OPNAVINST 4790.2 SERIES, NDI Technicians, NEC 7225/MOS 6044.

6. **Preparation of Aircraft.** No special preparation required.

7. **Access.** No special access required.

8. **RADIOGRAPHIC METHOD.**

**Support Equipment Required**

Part Number or Type Designation	Nomenclature
MIL-STD-453 GXR7-6B	Penetrameter Set X-ray Apparatus, Portable
072000 314X	X-ray Film Processor Film Identification Set
—	Lead Tab Locators

**Materials Required****NOTE**

Alternate item part numbers are shown indented.

**Specification or Part Number****Nomenclature**

INDUSTREX M  
FILM CODE M2

Radiographic Film,  
X-ray Film 14 x 17

INDUSTREXAA  
FILM CODE AA2  
14x17

Radiographic Film,  
X-ray Film 14x17

M83953-1 or -2

Pencil, Aircraft  
Marking

A-A-883, TYPE 1,1IN

Tape, Pressure  
Sensitive

9. **Preparation of Part.** No special preparation required.

**WARNING**

HIGH RADIATION.

Make sure applicable safety precautions (WP005 00) and NAVAIR 01-1A-16 are complied with. Failure to comply may result in injury to personnel.

10. **Equipment Settings/Standardization/Setup.**

a. Set X-ray unit per data contained in technique chart, see figure 2.

b. Attach lead tab locators and identification markers to upper surface of skin to core inspection area shown in figure 2. Attach penetrameter to lower surface of skin to core inspection area.

c. Locate X-ray source on deck, or make sure source window is at least 50 inches from lower surface.

**NOTE**

Alternate setup which locates X-ray source at least 50 inches above upper surface is allowed. If this alternate is used, reverse upper/lower surface locations of lead tab locators, identification markers, penetrameters, and film. Make sure film is in intimate contact with lower surface of part and M film is next to skin.

d. Make sure X-ray source window is parallel to upper surface of part or surface where film will be located, beam center ray should be perpendicular to plane of film.

**11. Inspection Procedure.****NOTE**

X-ray film for shots are double loaded. M film is located next to part surface and both films are exposed simultaneously.

a. Locate film on upper surface for shot 1, per figure 2. Make sure M film is nearest X-ray source and part and shot identifications are located between part surface and film.

b. Expose film for shot 1 per technique chart, see figure 2.

c. Remove film, of shot 1 exposure, from part surface.

d. Locate film on upper surface for shot 2 per figure 2. Make sure M film is nearest X-ray source and the part and shot identifications are located between part surface and film.

e. Expose film for shot 2 per technique chart, see figure 2.

f. Remove film of shot 2 exposure from part surface.

**NOTE**

Shot 3 for the 74A210004 assembly is not required.

g. For the 74A210001 assembly, locate film on upper surface for shot 3 per figure 2. Make sure M

film is nearest X-ray source and part and shot identifications are located between part surface and film.

h. Expose film for shot 3 per technique chart, see figure 2.

i. Remove film of shot 3 exposure from part surface.

**12. Film Development and Interpretation.**

a. Develop exposed films of shots 1, 2, and 3.

b. Review exposed film for failed honeycomb core. Compare appearance of honeycomb core indications with reference radiographs supplied. Torn core is usually associated with thin, dark, and light jogged lines across hexagonal cell faces. Wrinkled core is an acceptable condition.

**NOTE**

Torn core is most reliably detected when cell walls are laid over slightly. It is important to review film in areas where cell wall layover is observed. Interpret areas away from X-ray beam central ray.

c. Mark all areas on X-ray film where there are hexagonal cells with failed core indications.

d. Use figure 3 to determine number of failed shear paths in area of interest.

**13. ULTRASONIC METHOD USING C-398 ULTRASONIC FLAW DETECTOR.****Support Equipment Required****NOTE**

Alternate item type designations or part numbers are listed in parentheses.

<b>Part Number or Type Designation</b>	<b>Nomenclature</b>
C-398 (303B)	Ultrasonic Flaw Detector

### Support Equipment Required (Continued)

Part Number or Type Designation	Nomenclature
57A2271 or EQUIVALENT	Microdot to BNC Connecting Cable
57A2276 or EQUIVALENT	0°, 0.500 Dia., 2.25 MHz, Contact Delay Line Search Unit

### Materials Required

#### NOTE

Alternate item part numbers are shown indented.

Specification or Part Number	Nomenclature
ULTRAGEL II OR EQUIVALENT	Ultrasonic Couplant
M83953-1 or -2	Pencil, Aircraft Marking
P-D-680, TYPE 2 D 1153	Dry Cleaning Solvent Methyl Isobutyl Ketone
CCCC46TY1CL4	Cloth, Cleaning

#### WARNING

Dry cleaning solvent and methyl isobutyl ketone, are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

**14. Preparation of Part.** Clean inspection area of contamination or foreign material using cleaning cloth moistened with dry cleaning solvent or methyl isobutyl ketone.

**15. Location of Ballast.** See figure 2.

a. Use exposed and developed X-ray film to outline ballast area on upper surface of part of both configurations. Make sure film identification markers on part surface coincide with lead tab locators imaged on film when outlining ballast area.

b. Locate position of any foam splice lines which may interfere with ultrasonic responses.

#### WARNING

Make sure safety precautions have been met for electrical, static, grounding when using eddy current equipment near aircraft fuel cells, oxygen systems, electrical systems, and stores (A1-F18AC-PCM-000).

### 16. Equipment Settings/Standardization/Setup For Leading Edge Closure Ballast Area Skin to Core Bondlines.

a. Do general setup, including initial equipment settings, (WP008 01) except, use 0°, 0.500 inch diameter, 2.25 MHz contact delay search units.

#### NOTE

Equipment differences may require use of alternate REP. RATE, DAMP., FREQ., GAIN, and SWEEP DELAY and RANGE.

b. Apply couplant to upper and lower surfaces of calibration points shown in figure 4.

c. Position search units on both surfaces of part at calibration point.

#### NOTE

GAIN may be adjusted by changing FINE GAIN, COARSE GAIN, or by toggling ATTENUATORS.

d. Adjust GAIN, FINE SWEEP DELAY, FINE SWEEP RANGE, DAMPING, and REJECT so leading edge of received response is located at 4 on CRT horizontal baseline when peak amplitude is 80 to 90 percent CRT height, see figure 4, CRT 1. Minimum REJECT is recommended.

e. Make sure search unit alignment is correct.

**NOTE**

Initial search unit alignment may be established by maximizing signal response. Search unit alignment must be maintained during inspection. Alignment yoke may be manufactured as shown in (WP008 01). Alignment yokes are also commercially available.

f. Use previously taken radiographs to make sure search units are not positioned over core splice, multiple layers of adhesive, or core defects during setup.

g. After setup has been completed, move over foam splice and observe reduction in amplitude of received signal.

**17. Inspection Procedure For Leading Edge Closure Ballast Area Skin to Core Bondlines.**

a. Using through transmission setup described above, scan skin to core areas shown in figure 4.

**NOTE**

Scan approximately 2 inches from edge of ballast area in all skin to core area directions.

b. Make sure ballast area has been correctly outlined.

c. Mark all areas where through transmission received signal response peak drops below 5 percent CRT height even after up to 12 dB GAIN has been added. Flaw response will be similar to that shown in figure 4, CRT 2.

d. Use radiographic method to determine if suspect flaw area is result of extra layers of film adhesive, foaming adhesive, or core splice, see figure 5. Also, core defects such as crushed core or torn core will cause abnormal ultrasonic attenuation. Review films of suspected area for these types of anomalies.

e. Do paragraph 23.

**18. ULTRASONIC METHOD USING MXU-715/E ULTRASONIC FLAW DETECTOR.**

**Support Equipment Required**

Part Number or Type Designation	Nomenclature
1642AS100-1	Ultrasonic Flaw Detector, MXU-715/E, Magnaflux
57A2271 or EQUIVALENT	Microdot to BNC Connecting Cable
57A2276 or EQUIVALENT	0°, 0.500 Dia., 2.25 MHz, Contact Delay Line Search Unit

**Materials Required**

Specification or Part Number	Nomenclature
ULTRAGEL II OR EQUIVALENT	Ultrasonic Couplant
M83953-1 or -2	Pencil, Aircraft Marking
020X413	Cleaning Compound
CCCC46TY1CL4	Cloth, Cleaning

## WARNING

Cleaning compound is flammable liquid and vapor. May cause allergic respiratory and skin reaction. May cause eye, skin and respiratory irritation. Keep away from heat, sparks, and flame. Do not breathe dust (vapor, mist, gas). Use only with adequate ventilation. Keep container closed. Avoid contact with eyes, skin and clothing. Wash thoroughly after handling.

### 19. Preparation of Part.

a. Clean inspection area(s) of contamination or foreign material using cleaning cloth moistened with cleaning compound. Allow to air dry for 15 minutes.

### 20. Location of Ballast. See figure 2.

a. Use exposed and developed X-ray film to outline ballast area on upper surface of part of both configurations. Make sure film identification markers on part surface coincide with lead tab locators imaged on film when outlining ballast area.

b. Locate position of any foam splice lines which may interfere with ultrasonic responses.

## WARNING

Make sure safety precautions have been met for electrical, static, grounding when using eddy current equipment near aircraft fuel cells, oxygen systems, electrical systems, and stores (A1-F18AC-PCM-000).

### 21. Equipment Settings/Standardization/Setup For Leading Edge Closure Ballast Area Skin to Core Bondlines.

a. Do general setup, including initial equipment settings, (WP008 10) except, use 0°, 0.500 inch diameter, 2.25 MHz contact delay search units.

## WARNING

Couplant may cause eye irritation. Avoid contact with eyes. Wash thoroughly after handling.

## NOTE

Equipment differences may require use of alternate REP. RATE, DAMP., FREQ., GAIN, and HORIZONTAL SWEEP DELAY and LENGTH.

b. Apply couplant to upper and lower surfaces of calibration points shown in figure 4.

c. Position search units on both surfaces of part at calibration point.

d. Adjust GAIN, HORIZONTAL SWEEP DELAY and LENGTH, DAMPING, and REJECT so leading edge of received response is located at 4 on CRT horizontal baseline when peak amplitude is 80 to 90 percent CRT height, see figure 4, CRT 1. Minimum REJECT is recommended.

e. Make sure search unit alignment is correct.

## NOTE

Initial search unit alignment may be established by maximizing signal response. Search unit alignment must be maintained during inspection. Alignment yoke may be manufactured as shown in (WP008 10). Alignment yokes are also commercially available.

f. Use previously taken radiographs to make sure search units are not positioned over core splice, multiple layers of adhesive, or core defects during setup.

g. After setup has been completed, move over foam splice and observe reduction in amplitude of received signal.

### 22. Inspection Procedure For Leading Edge Closure Ballast Area Skin to Core Bondlines.

a. Using through transmission setup described above, scan skin to core areas shown in figure 4.

## NOTE

Scan approximately 2 inches from edge of ballast area in all skin to core area directions.

b. Make sure ballast area has been correctly outlined.

c. Mark all areas where through transmission received signal response peak drops below 5 percent CRT height even after up to 12 dB GAIN has been added. Flaw response will be similar to that shown in figure 4, CRT 2.

d. Use radiographic method to determine if suspect flaw area is result of extra layers of film adhesive, foaming adhesive, or core splice, see figure 5. Also, core defects such as crushed core or torn core will cause abnormal ultrasonic attenuation. Review films of suspected area for these types of anomalies.

## WARNING

Cleaning compound is flammable liquid and vapor. May cause allergic respiratory and skin reaction. May cause eye, skin and respiratory irritation. Keep away from heat, sparks, and flame. Do not breathe dust (vapor, mist, gas). Use only with adequate ventilation. Keep container closed. Avoid contact with eyes, skin and clothing. Wash thoroughly after handling.

23. **POST INSPECTION CLEANING AND CORROSION CONTROL.** Clean all couplant and markings from inspection area using cleaning cloth moistened with cleaning compound. Allow to air dry for 15 minutes.



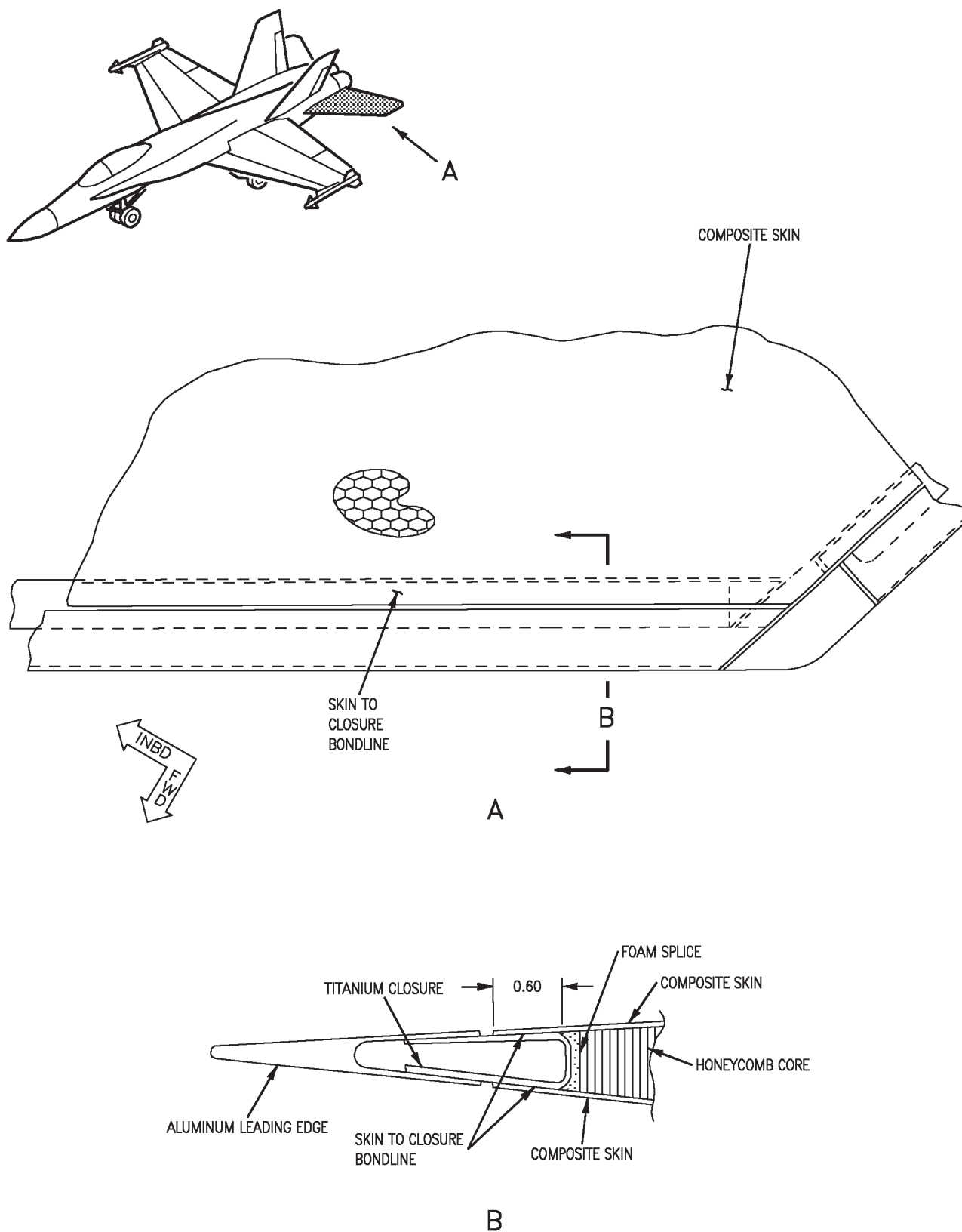


Figure 1. Horizontal Stabilizer Leading Edge Closure (Sheet 1)



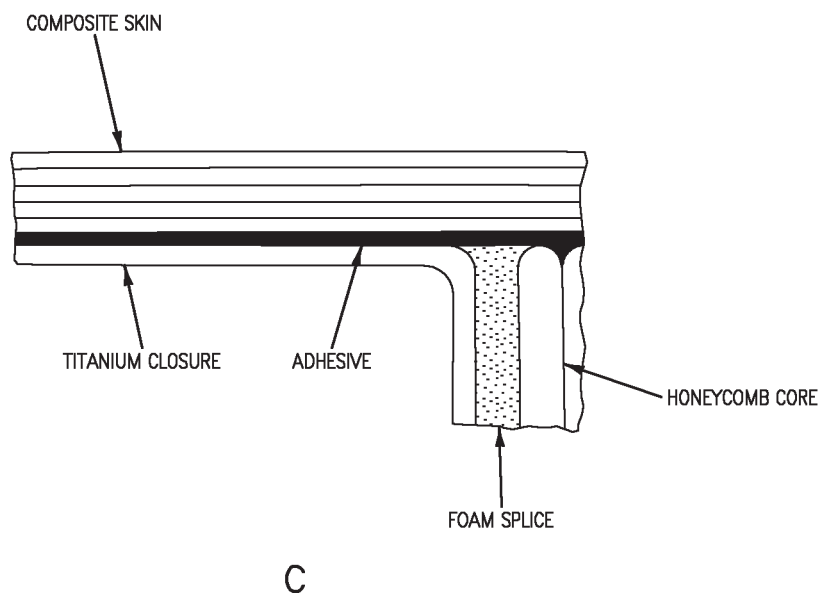
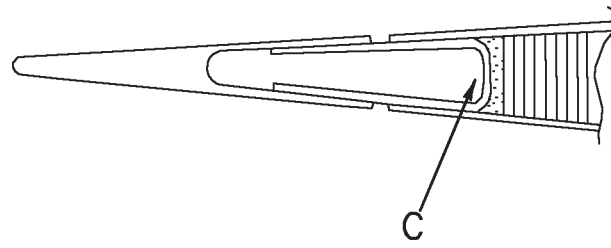
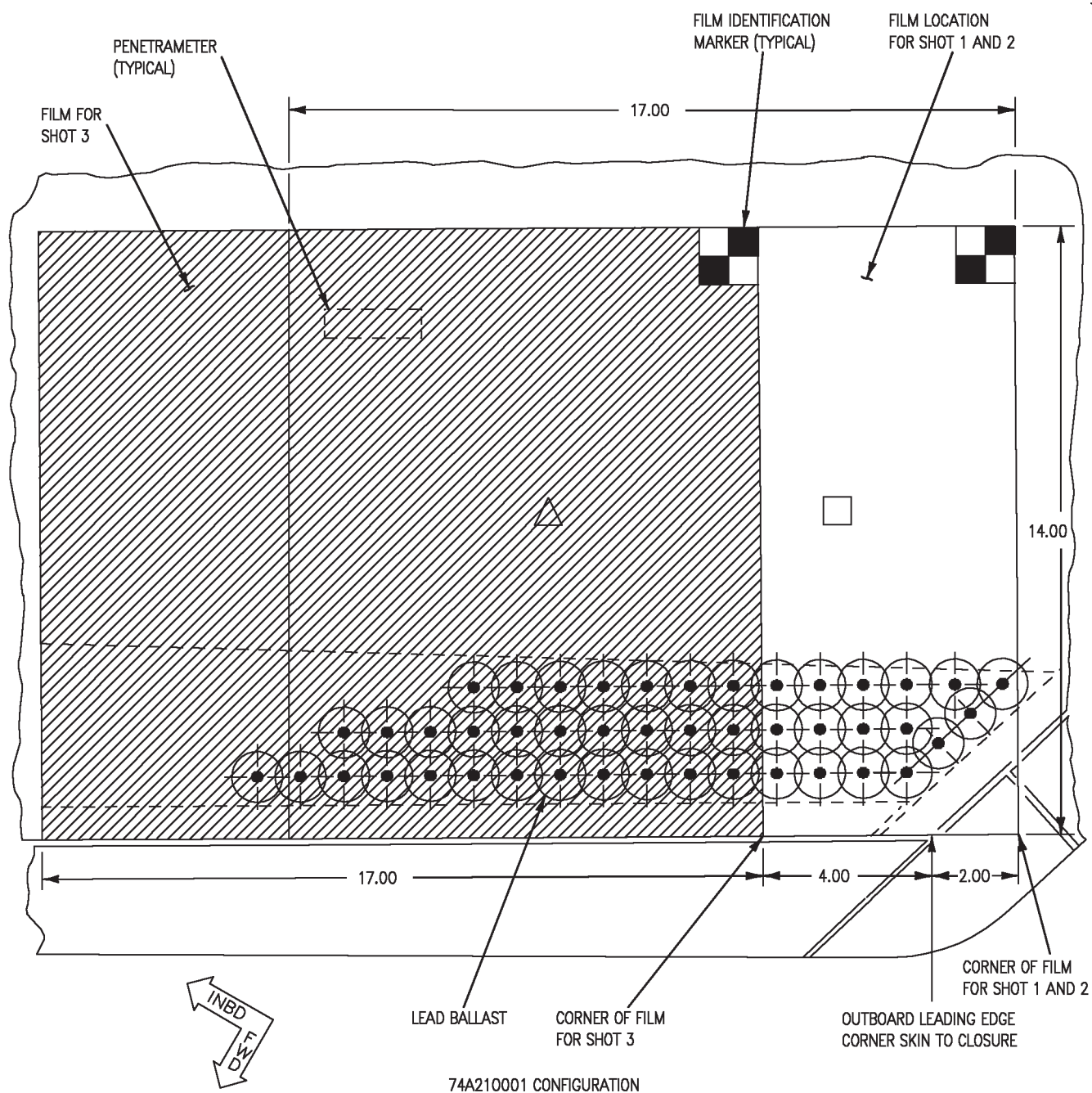
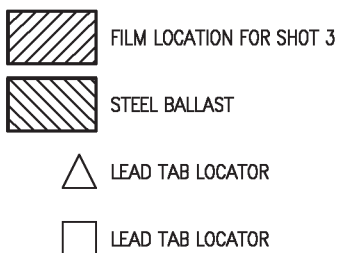


Figure 1. Horizontal Stabilizer Leading Edge Closure (Sheet 2)



## LEGEND



**Figure 2. X-Ray Setup for Honeycomb Core Inspection and Locating Ballast (Sheet 1)**

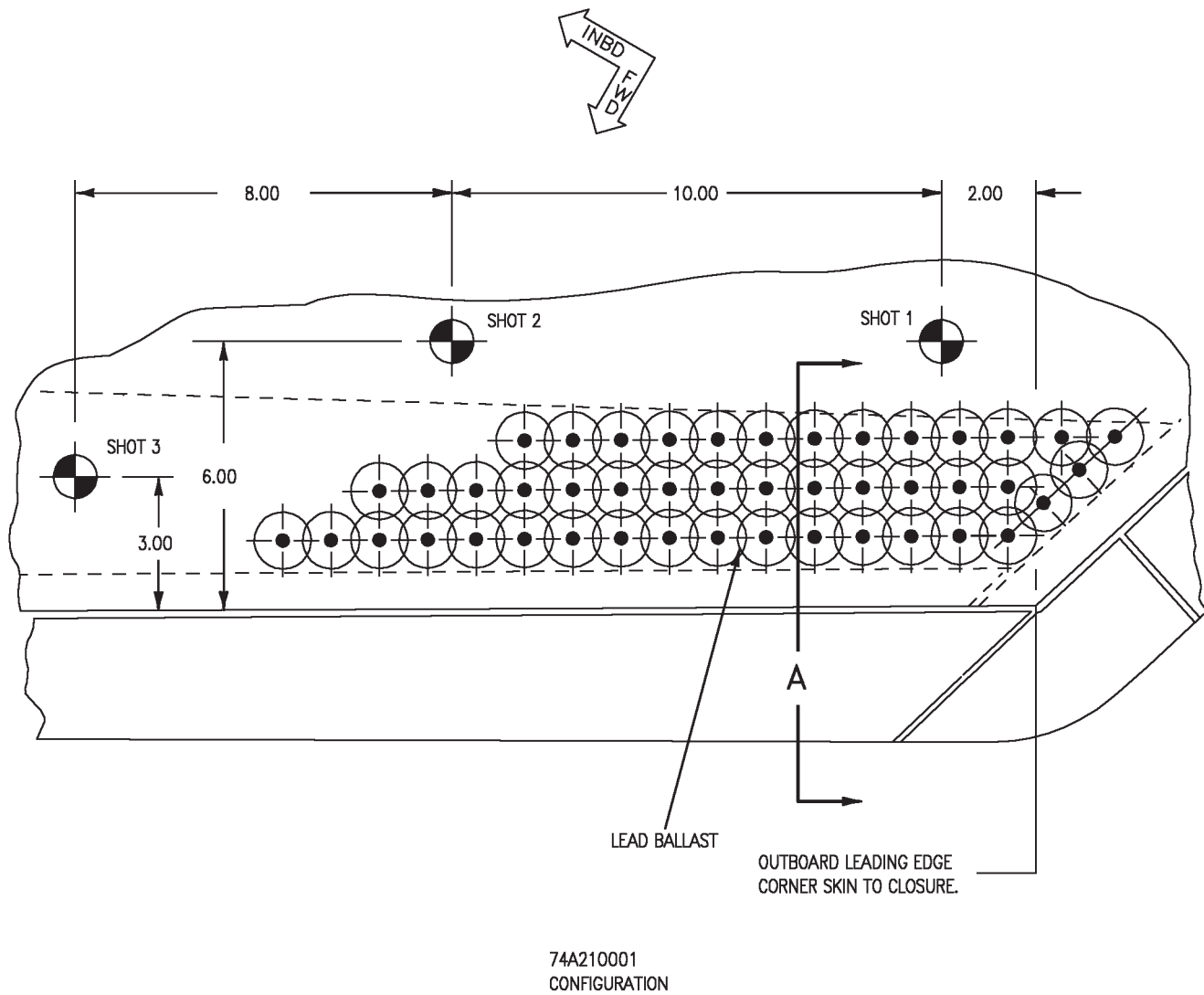


Figure 2. X-Ray Setup for Honeycomb Core Inspection and Locating Ballast (Sheet 2)

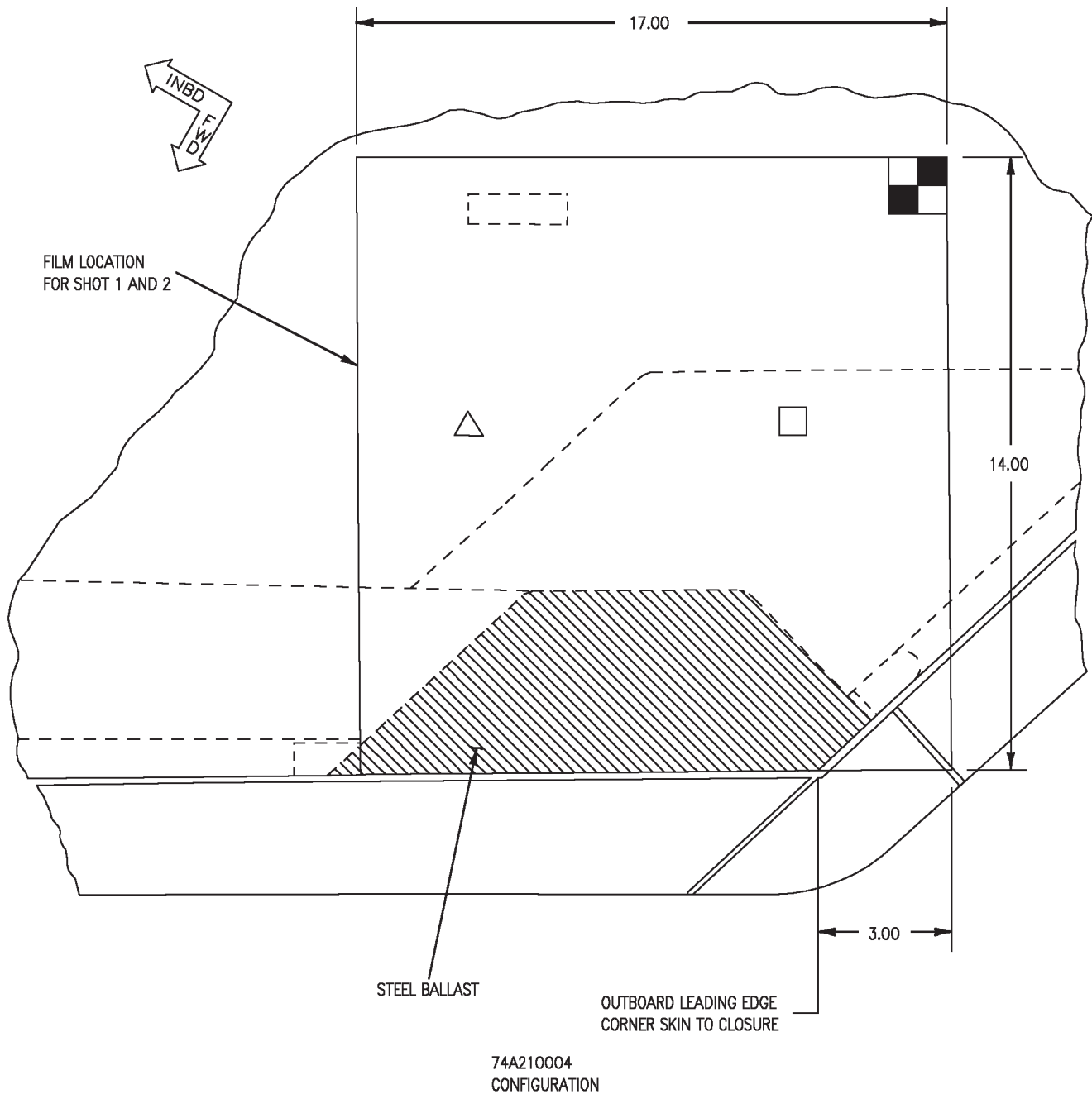
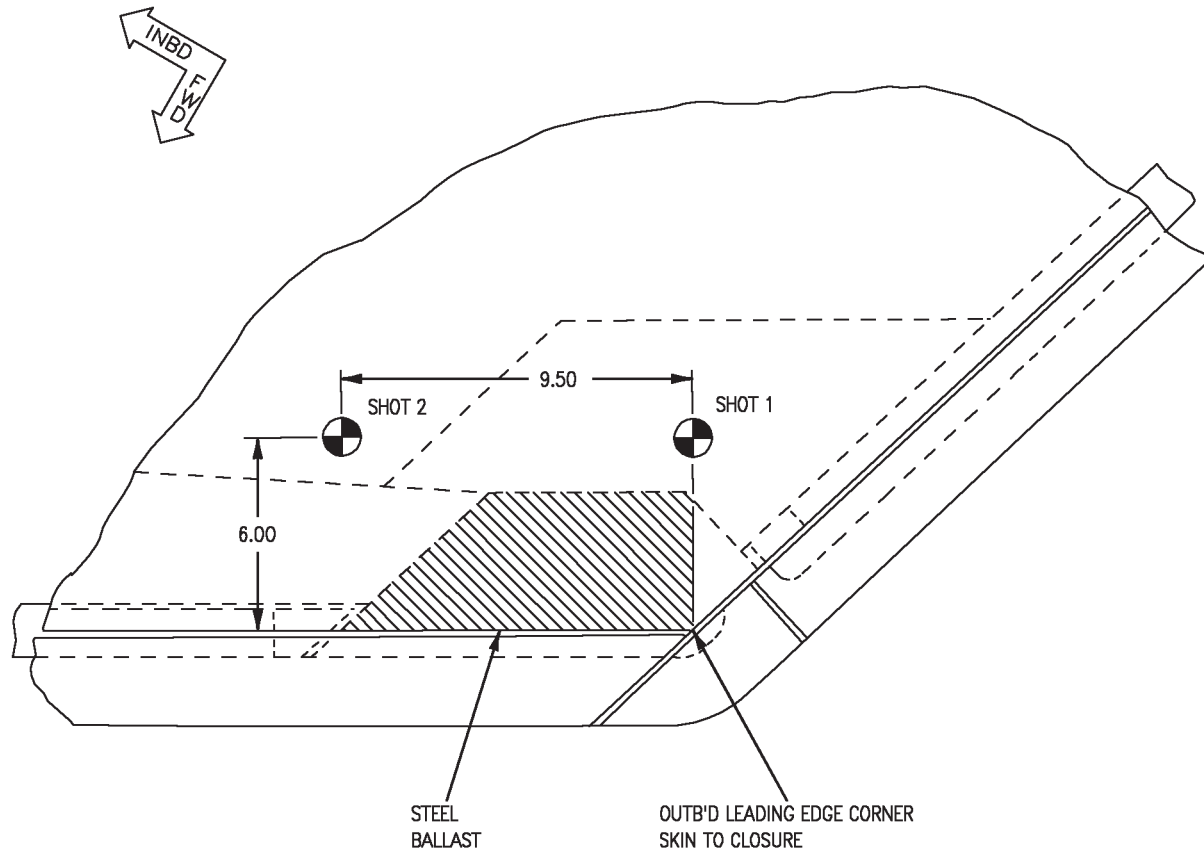


Figure 2. X-Ray Setup for Honeycomb Core Inspection and Locating Ballast (Sheet 3)

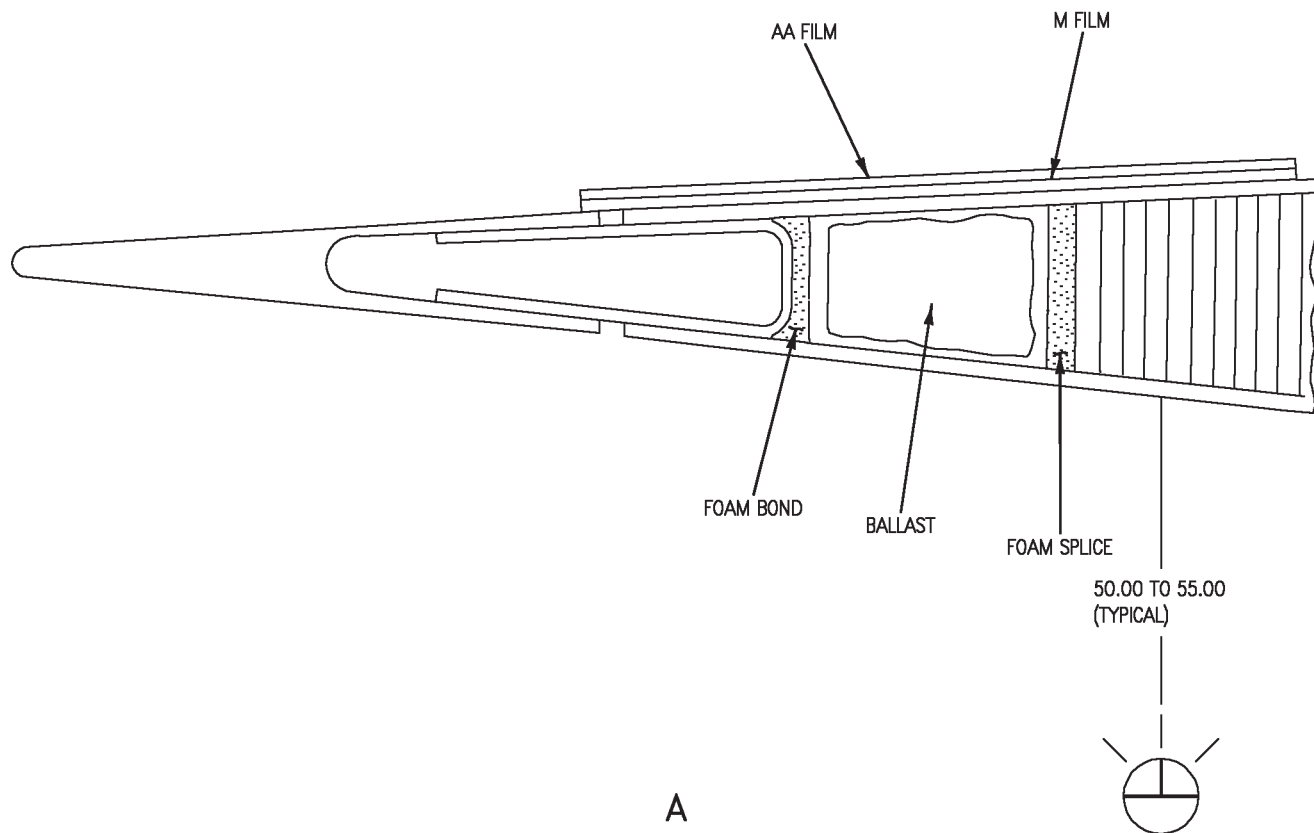
18AC-SRM-310-(61-3)01-SCAN



74A210004  
CONFIGURATION

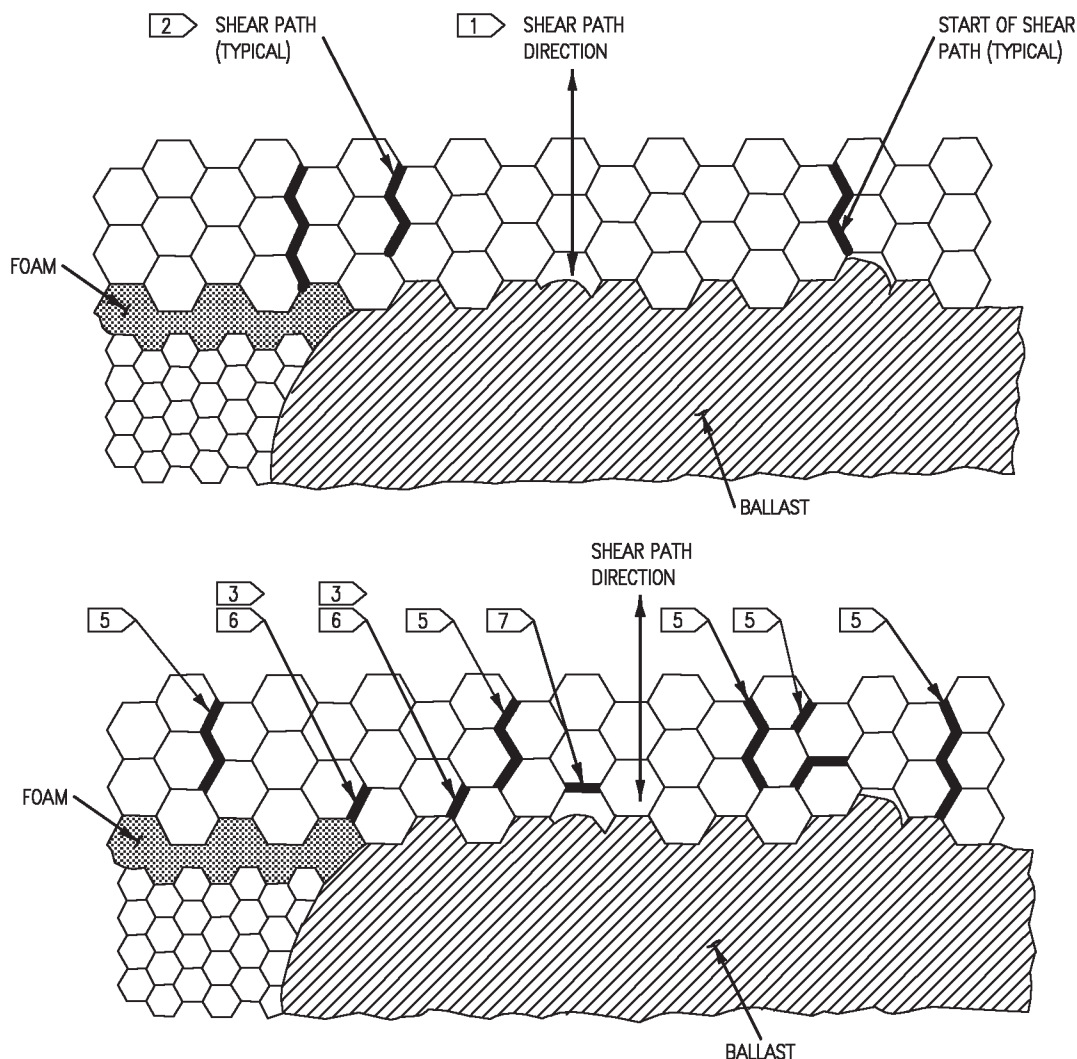
Figure 2. X-Ray Setup for Honeycomb Core Inspection and Locating Ballast (Sheet 4)

18AC-SRM-310-(61-4)01-SCAN



TECHNIQUE CHART								
SHOT	FILM SIZE	FILM GROUP	SCREEN	PENETRAMETER MIL-STD-453	mA	kVP	EXPOSURE (MINUTES)	DENSITY
1	14X17	AA AND M	NO	0.25 AL	5	45	1	1.5-2.5
2	14X17	AA AND M	NO	0.25 AL	5	45	1	1.5-2.5
3	14X17	AA AND M	NO	0.25 AL	5	45	1	1.5-2.5

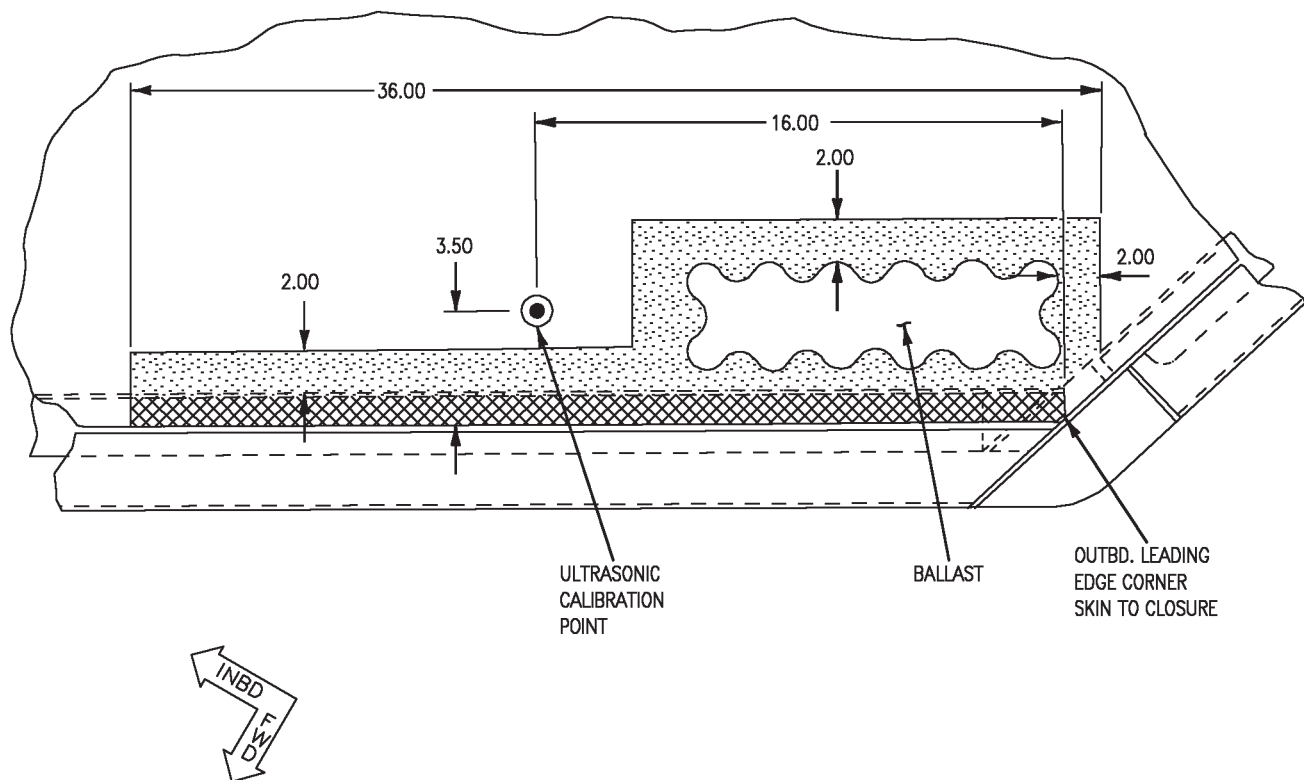
Figure 2. X-Ray Setup for Honeycomb Core Inspection and Locating Ballast (Sheet 5)





## LEGEND

- 1 SHEAR PATH DIRECTION IS PERPENDICULAR TO AFT EDGE OF STEEL BALLAST IN THE 74A210004 CONFIGURATION.
- 2 TYPICAL SHEAR PATH IS MOST DIRECT PATH ALONG CELL WALLS IN SHEAR PATH DIRECTION.
- 3 OMIT EVALUATION OF CELLS IN CONTACT WITH BALLAST. DO EVALUATE CELLS IN CONTACT WITH FOAM ADHESIVE.
4. WHEN INDEXING, ALIGN STRAIGHT EDGE PARALLEL TO SHEAR PATH DIRECTION AND COINCIDENT WITH CELL NODES. INDEX STRAIGHT EDGE IN INBOARD OUTBOARD DIRECTION ONE CELL WALL DIAMETER DURING EVALUATION.
- 5 FAILED SHEAR PATHS (5 TOTAL IN ABOVE FIGURE)
- 6 FAILURE IN CELL NEXT TO BALLAST (NOT PART OF SHEAR PATH).
- 7 FAILURE NOT IN SHEAR PATH.
- CELL WALL FAILURES.

**Figure 3. Definition and Example of Failed Shear Paths**

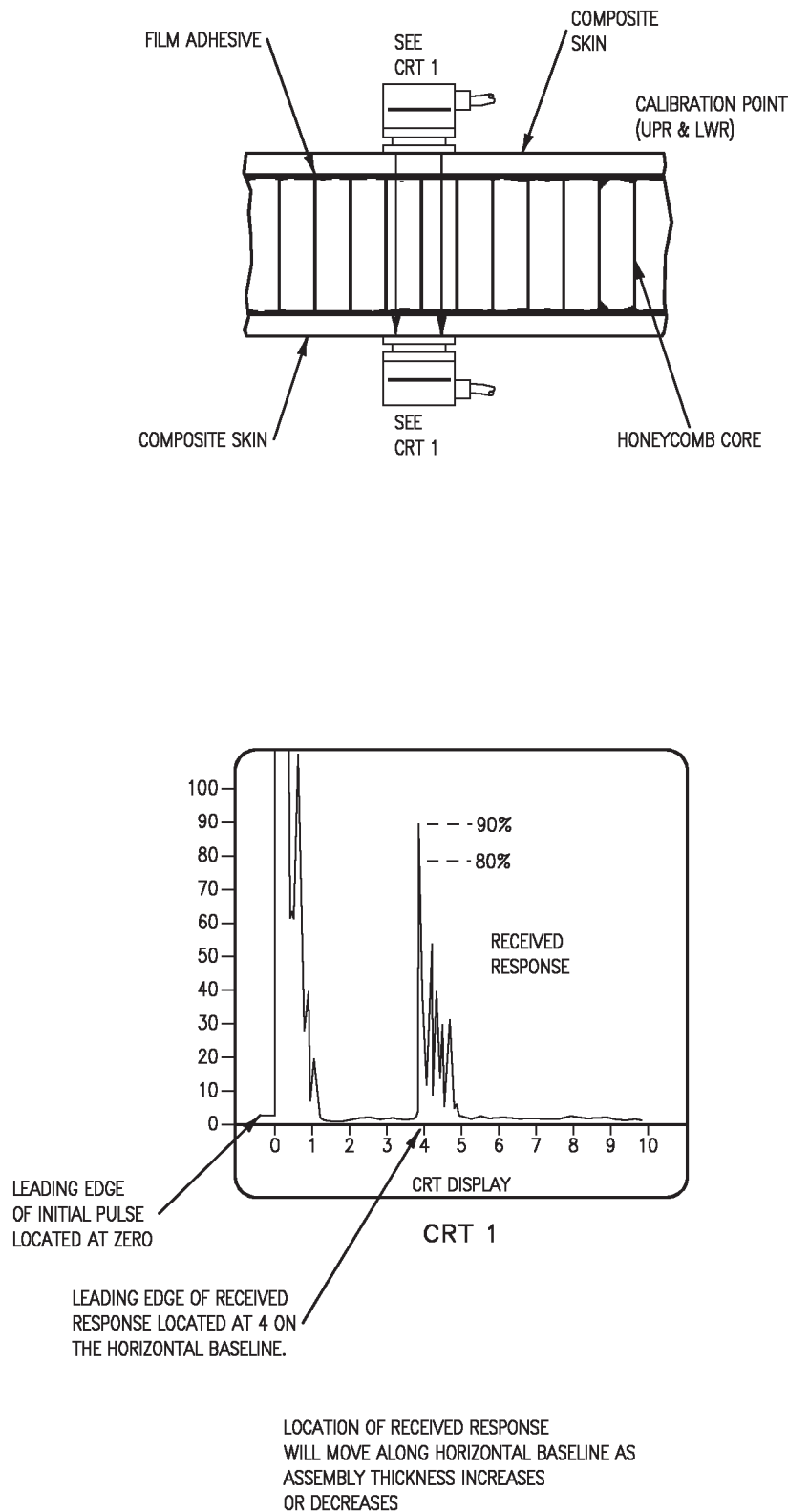


## LEGEND

-  SKIN TO CLOSURE AREA  
UPPER AND LOWER
  -  SKIN TO CORE AREA  
UPPER AND LOWER

**Figure 4. Ultrasonic Through Transmission Setup and Inspection (Sheet 1)**





**Figure 4. Ultrasonic Through Transmission Setup and Inspection (Sheet 2)**

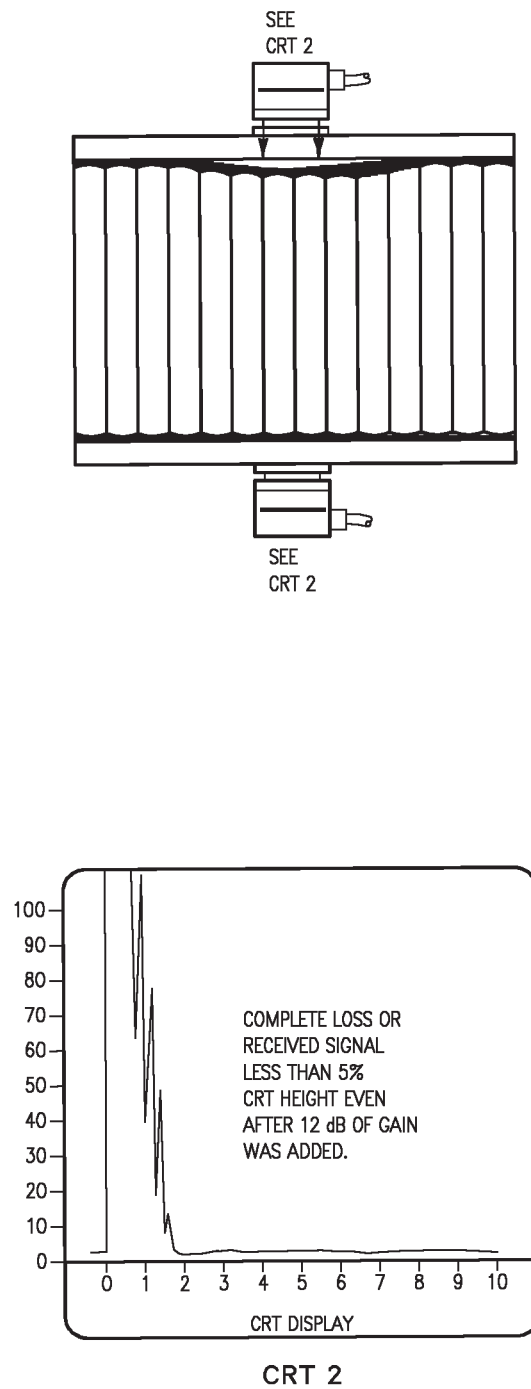
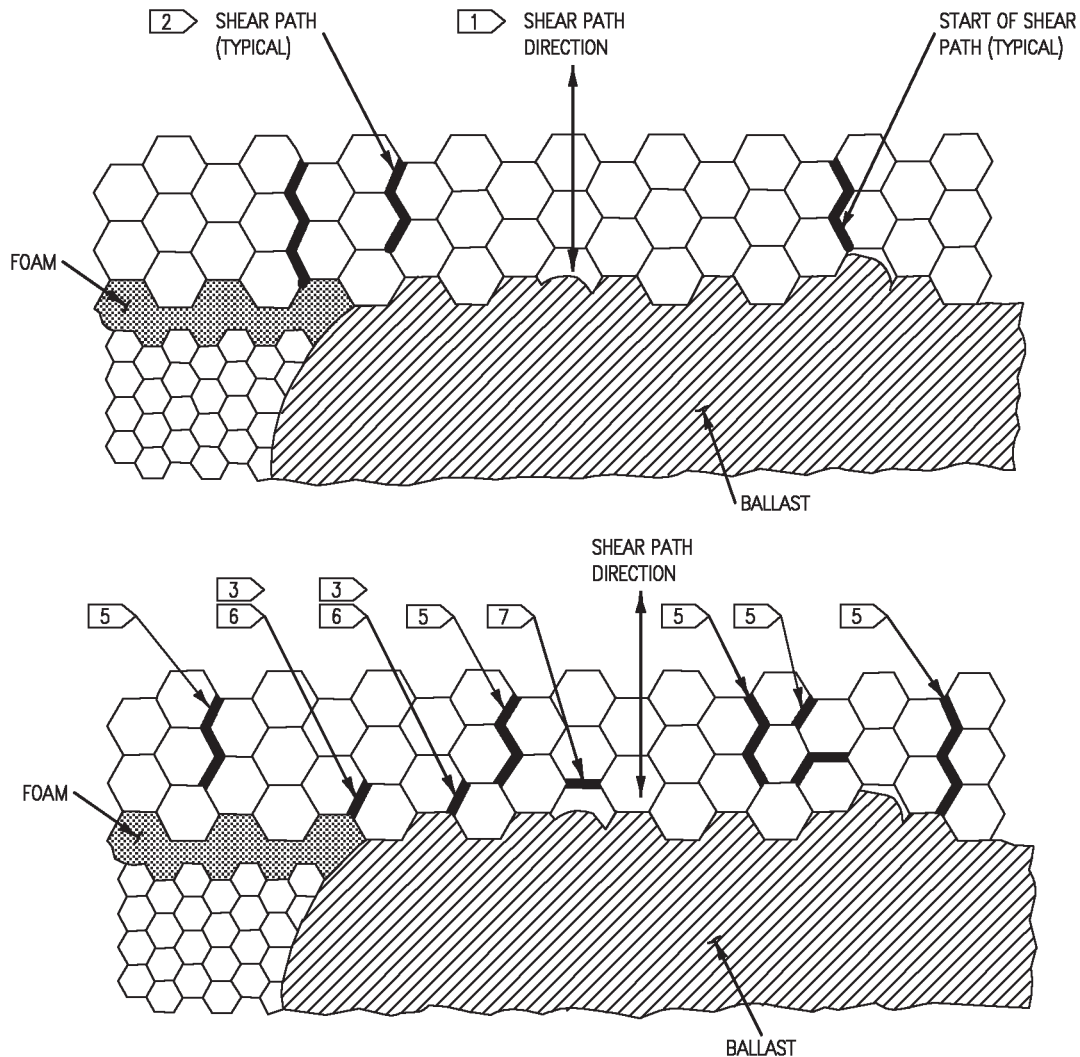


Figure 4. Ultrasonic Through Transmission Setup and Inspection (Sheet 3)



### LEGEND

- 1 SHEAR PATH DIRECTION IS PERPENDICULAR TO AFT EDGE OF STEEL BALLAST IN THE 74A210004 CONFIGURATION.
- 2 TYPICAL SHEAR PATH IS MOST DIRECT PATH ALONG CELL WALLS IN SHEAR PATH DIRECTION.
- 3 OMIT EVALUATION OF CELLS IN CONTACT WITH BALLAST. DO EVALUATE CELLS IN CONTACT WITH FOAM ADHESIVE.
4. WHEN INDEXING, ALIGN STRAIGHT EDGE PARALLEL TO SHEAR PATH DIRECTION AND COINCIDENT WITH CELL NODES. INDEX STRAIGHT EDGE IN INBOARD OUTBOARD DIRECTION ONE CELL WALL DIAMETER DURING EVALUATION.
- 5 FAILED SHEAR PATHS (5 TOTAL IN ABOVE FIGURE)
- 6 FAILURE IN CELL NEXT TO BALLAST (NOT PART OF SHEAR PATH).
- 7 FAILURE NOT IN SHEAR PATH.
- CELL WALL FAILURES.

**Figure 5. Example of Failed Shear Paths**



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**INTERMEDIATE MAINTENANCE****NONDESTRUCTIVE INSPECTION****HORIZONTAL STABILATOR****SKIN TO CORE UNBONDS AND SKIN DELAMINATIONS/SKIN TO CLOSURE UNBONDS AND SKIN DELAMINATIONS****PART NO. 74A210004**

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**Reference Material**

Plane Captain Manual .....	A1-F18AC-PCM-000
Naval Aviation Maintenance Program .....	OPNAVINST 4790.2
Nondestructive Inspection .....	A1-F18AC-SRM-300
General Information .....	WP003 00
Ultrasonic Through Transmission Contact Testing, Standardization, and Inspection Procedures for Composite Laminate Skins Bonded to Honey- comb Core .....	WP008 01
Pulse-Echo, Longitudinal Wave Contact Without Delay Line, for Compos- ite Laminate Material .....	WP008 02
Pulse-Echo, Longitudinal Wave Contact, with Delay Line, for Composite Laminate Material Bonded to Honeycomb Core .....	WP008 04
Ultrasonic Resonance Inspection with Fokker Bond Tester .....	WP008 06
Ultrasonic Through Transmission Contact Testing, Standardization, and Inspection Procedures for Composite Laminate and Metallic Skins Bonded to Honeycomb Core .....	WP008 10
Pulse-Echo Longitudinal, Contact, Without Delay Line, For Composite Laminate Materials .....	WP008 11
Pulse-Echo Longitudinal, Contact, With Delay Line, For Composite Lami- nate material Bonded to Honeycomb Core .....	WP008 13
Pulse-Echo Shear Wave, Angle Beam, Contact of Metallic Materials .....	WP008 14

**Alphabetical Index**

<b>Subject</b>	<b>Page No.</b>
Horizontal Stabilator .....	2
Defects .....	2
Post Inspection Cleaning and Corrosion Control .....	11
Primary Inspection Method .....	2
Ultrasonic Method Using C-398 Ultrasonic Flaw Detector .....	2
Ultrasonic Method Using MXU-715/E Ultrasonic Flaw Detector .....	8

## Record of Applicable Technical Directives

None

## 1. HORIZONTAL STABILATOR.

2. See figure 1. Horizontal stabilator is bonded honeycomb assembly. Honeycomb core is 0.125, 0.156, 0.188, and 0.250 inch hexagonal cell aluminum alloy. Skin is graphite epoxy with titanium splice plate in spindle area. Structure enclosing core is titanium spars, ribs, and graphite epoxy rib. Surface finish is epoxy primer and polyurethane coatings.

3. **DEFECTS.** Inspect for skin to core and skin to closure unbonds. Example of skin to core unbonds that may develop in a bonded assembly are contained in (WP003 00).

4. **PRIMARY INSPECTION METHOD.** Primary inspection method is ultrasonic.

5. **Personnel Qualifications.** Personnel doing this nondestructive inspection should be qualified and certified to do ultrasonic inspections per OPNAVINST 4790.2 SERIES, NDI Technicians, NEC 7225/MOS 6044.

6. **Preparation of Aircraft.** No special preparation required.

7. **Access.** No special access required.

8. ULTRASONIC METHOD USING C-398  
ULTRASONIC FLAW DETECTOR.Support Equipment Required  
(Continued)

## NOTE

Alternate item type designations or part numbers are listed in parentheses.

Part Number or Type Designation	Nomenclature
57A2271 or EQUIVALENT	Microdot to BNC Connecting Cable, 2 Reqd.
57A2214 or EQUIVALENT	0°, 0.250 Dia., 5 MHz, Contact Delay Line Search Unit
57A7101 or EQUIVALENT	0°, 0.500 Dia., 1 MHz, Contact Delay Line Search Unit, 2 Reqd.
57A2276 or EQUIVALENT	0°, 0.500 Dia., 2.25 MHz, Contact Delay Line Search Unit, 2 Reqd.
3814 Model 80 Yellow Bond Tester Adapter 74D110175-1001	Fokker Probe Fokker bond Tester Probe Adapter Assembly Graphite Epoxy Ultrasonic Reference Standard Set:
74D111295-1005	Honeycomb Reference Standard with Graphite Epoxy Skin for Sandwich Assemblies Less Than 1 Inch Thick
74D111295-1003	Honeycomb Reference Standard with Graphite Epoxy Skins for Sandwich Assemblies 1 to 2 Inches Thick

## Support Equipment Required

## NOTE

Alternate item type designations or part numbers are listed in parentheses.

Part Number or Type Designation	Nomenclature
C-398 (303B)	Ultrasonic Flaw Detector

## Support Equipment Required (Continued)

### NOTE

Alternate item type designations or part numbers are listed in parentheses.

Part Number or Type Designation	Nomenclature
74D111295-1001	Honeycomb Reference Standard with Graphite Epoxy Skins for Sandwich Assemblies 2 Inches or Taller

## Materials Required

Specification or Part Number	Nomenclature
ULTRAGEL II OR EQUIVALENT M83953-1 or -2	Ultrasonic Couplant
020X413	Pencil, Aircraft Marking
CCCC46TY1CL4	Cleaning Compound
MIL-I-25135	Cloth, Cleaning Penetrant Emulsifier

### 9. Preparation of Part.

### WARNING

Cleaning compound is flammable liquid and vapor. May cause allergic respiratory and skin reaction. May cause eye, skin and respiratory irritation. Keep away from heat, sparks, and flame. Do not breathe dust (vapor, mist, gas). Use only with adequate ventilation. Keep container closed. Avoid contact with eyes, skin and clothing. Wash thoroughly after handling.

a. Clean both surfaces of inspection area(s) of contamination or foreign material using cleaning cloth moistened with cleaning compound. Allow surfaces to air dry for 15 minutes.

b. On horizontal stabilator surface locate, mark, and identify inspection areas, core splice lines, and boundaries as shown in figures 1 and 2.

### WARNING

Make sure safety precautions are met for electrical, static, grounding when using ultrasonic equipment near aircraft fuel cells, oxygen systems, electrical systems, electronic systems, and stores (A1-F18AC-PCM-000).

### 10. Equipment Settings/Standardization/Setup For Skin to Core Areas. See figures 3, 4, and 5.

### NOTE

Equipment differences may require use of alternate REP. RATE, DAMP., FREQ., GAIN, SWEEP DELAY, and SWEEP LENGTH.

a. Do Equipment Setting/Standardization/Setup, General, including initial equipment settings (WP008 01).

b. For areas on horizontal stabilator, select graphite epoxy skinned honeycomb reference standard for part thickness in inspection area (WP008 01). For splice plate areas, use reference standard specified for 2 inches or taller core (WP008 01).

c. Do equipment setting/standardization/setup (WP008 01), except as below:

(1) Use two 0°, 0.500 inch diameter, 2.25 MHz, contact delay line search units for all areas except splice plate areas.

(2) For splice plate areas on horizontal stabilator, use two 0°, 0.500 inch diameter, 1 MHz, contact delay line search units.

(3) Use P-1 calibration point of graphite epoxy skinned honeycomb core sandwich assembly reference standard (WP008 01).

(4) Make sure correct response is being received by removing microdot cable from R BNC jack and observing total disappearance of received response.

## 11. Inspection Procedure For Skin to Core Areas.

See figures 6, 7, and 8.

a. Do inspection procedure (WP008 01), except as below:

(1) Use two 0°, 0.500 inch diameter, 2.25 MHz, contact search units for all areas except splice plate areas. See figure 9.

(2) For splice plate areas on horizontal stabilator, use two 0°, 0.500 inch diameter, 1 MHz, contact search units.

(3) Make sure initial pulse width does not interfere with location of received response. If required, use different search unit on receiver cable.

(4) For splice plate areas, scan parallel to steps. Decrease in response peak amplitude may occur when crossing steps. Examples of response from good and delaminated areas are shown in figure 10, CRTs 1 and 2.

(5) Mark all areas with aircraft marking pencil where through transmission received response drops below 5 percent of received response is shifted more than 1-1/2 large division on CRT horizontal baseline. For examples of flaw responses, (WP008 01).

(6) Use ultrasonic pulse-echo method (WP008 04) to determine if above marked area, substep (5), is result of skin delamination. Do pulse-echo inspection of both surfaces to help identify location of flaw causing through transmission unbond response. Use figure 1 to identify skin thickness in marked areas.

### NOTE

Equipment differences may require use of alternate REP. RATE, DAMP., FREQ., GAIN, SWEEP DELAY, and SWEEP RANGE.

## 12. Equipment Settings/Standardization/Setup

**For Filled Area.** Do Equipment Settings/Standardization/Setup, General, including initial equipment settings, (WP008 02), except; use 0°, 0.375 inch diameter, 2.25 MHz, contact delay line search unit.

### NOTE

Following completion of general setup, initial pulse leading edge should be located at 0 on the CRT horizontal baseline. See figure 12, CRT 1.

## 13. Inspection of Filled Area.

a. Outline inspection area with aircraft marking pencil. For inspection area, figure 11.

b. Apply couplant to one side of inspection area.

c. Position search unit on inspection area and adjust COARSE GAIN so reflected response is similar to figure 12, CRT 1.

d. Scan area to be inspected and use finger damping on back surface of inspection area. Place couplant on end of finger and touch opposite surface of inspection area beneath search unit. As finger touches surface and is removed, reflected responses will move up and down, damp, on CRT indicating good bond.

e. Unbond or delamination on search unit side of inspection area will cause loss of reflected signal on CRT, see figure 12, CRT 2.

f. Unbond or delamination on surface opposite search unit will result in no movement of reflected signal on CRT, see figure 12, CRT 3.

g. Mark all areas with aircraft marking pencil where reflected response is lost, figure 12, CRT 2, or cannot be damped, figure 12, CRT 3.

h. Use ultrasonic pulse-echo method to determine if above marked area is result of skin delaminations (WP008 04). See figure 7 to identify skin thickness in area marked.

## 14. Equipment Settings/Standardization/Setup

**For Skin To Closure Area.** For skin to closure bondline at leading edge, see figure 13, do Equipment Settings/Standardization/Setup for Model 80 Fokker Bond Tester (WP008 06), except as below:



- a. Set bond tester front face settings:

DSP ..... ACTIVATED  
 MODE ..... M  
 S (SWEEP RATE) ..... 1  
 R (SWEEP RANGE) .... 5  
 F (FREQUENCY  
 BAND) ..... 5

#### NOTE

It is important to use correct amount of couplant. Not enough couplant will give incorrect response.

- b. Apply couplant to skin to core area shown in figures 13 and 14.

- c. Position probe on skin to core area.

- d. Use FREQ., FINE, and GAIN to get unbond A-scale response of  $0 \pm 1$  KHz and B-scale response of approximately 100. See figure 14, display 1.

- e. Reposition probe over known nearby good bond area and observe good bond response. For this procedure, typical good bond response has A-scale display between -20 and -40 KHz and B-scale of 122, B-scale maximum, see figure 14.

#### 15. Inspection Procedure For Skin To Closure

**Area.** For skin to closure bondline at leading edge, do Inspection Procedure (WP008 06), except as below:

- a. Outline inspection area with aircraft marking pencil, see figure 13.

- b. Apply couplant to inspection area. Use distilled water if leading edge of skin is open to edge.

- c. Position probe on upper or lower surface of inspection area.

#### NOTE

When abnormal amount of fairing material or metal strap doubler has been used in skin to closure area, delete inspection in this area. Abnormal amount of fairing material is indicated by A-scale air response even with correct coupling.

- d. Inspect skin to closure bondline by monitoring A-scale numeric display. Maintain good coupling because air responses will appear similar to unbond response. Use scan index of 3/16 inch or half probe diameter.

- e. Areas displaying A-scale response of -5 KHz through 5 KHz indicate unbond.

- f. Mark all unbond response areas with aircraft marking pencil.

- g. Do paragraph 24.





# 15A. ULTRASONIC METHOD USING MXU-715/E ULTRASONIC FLAW DETECTOR.

## Support Equipment Required

Part Number or Type Designation	Nomenclature
1642AS100-1	Ultrasonic Flaw Detector, MXU-715/E, Magnaflux
57A2271 or EQUIVALENT	Microdot to BNC Connecting Cable, 2 Req'd.
57A2214 or EQUIVALENT	0°, 0.250 Dia., 5 MHz, Contact Delay Line Search Unit
57A7101 or EQUIVALENT	0°, 0.500 Dia., 1 MHz, Contact Delay Line Search Unit, 2 Req'd.
57A2276 or EQUIVALENT	0°, 0.500 Dia., 2.25 MHz, Contact Delay Line Search Unit, 2 Req'd.
3814 Model 80 Yellow Bond Tester Adapter	Fokker Probe Fokker bond Tester Probe Adapter Assembly
74D110175-1001	Graphite Epoxy Ultrasonic Reference Standard Set:
74D111295-1005	Honeycomb Reference Standard with Graphite Epoxy Skin for Sandwich Assemblies Less Than 1 Inch Thick
74D111295-1003	Honeycomb Reference Standard with Graphite Epoxy Skins for Sandwich Assemblies 1 to 2 Inches Thick
74D111295-1001	Honeycomb Reference Standard with Graphite Epoxy Skins for Sandwich Assemblies 2 Inches or Taller

## Materials Required

Specification or Part Number	Nomenclature
ULTRAGEL II OR EQUIVALENT	Ultrasonic Couplant
M83953-1 or -2	Pencil, Aircraft Marking
020X413	Cleaning Compound
CCCC46TY1CL4	Cloth, Cleaning
MIL-I-25135	Penetrant Emulsifier

## 15B. Preparation of Part.

### WARNING

Cleaning compound is flammable liquid and vapor. May cause allergic respiratory and skin reaction. May cause eye, skin and respiratory irritation. Keep away from heat, sparks, and flame. Do not breathe dust (vapor, mist, gas). Use only with enough ventilation. Keep container closed. Avoid contact with eyes, skin and clothing. Wash thoroughly after handling.

a. Clean both surfaces of inspection area(s) of contamination or foreign material using cleaning cloth moistened with cleaning compound. Allow surfaces to air dry for 15 minutes.

b. On horizontal stabilator surface locate, mark, and identify inspection areas, core splice lines, and boundaries as shown in figures 1 and 2.

### WARNING

Make sure safety precautions are met for electrical, static, grounding when using ultrasonic equipment near aircraft fuel cells, oxygen systems, electrical systems, electronic systems, and stores (A1-F18AC-PCM-000).

## 15C. Equipment Settings/Standardization/Setup For Skin to Core Areas. See figures 3, 4, and 5.

## NOTE

Equipment differences may require use of alternate REP. RATE, DAMP., FREQ., GAIN, and HORIZONTAL SWEEP DELAY and LENGTH.

### a. Do Equipment

Setting/Standardization/Setup, General, including initial equipment settings (WP008 10).

b. For areas on horizontal stabilator, select graphite epoxy skinned honeycomb reference standard for part thickness in inspection area (WP008 10). For splice plate areas, use reference standard specified for 2 inches or taller core (WP008 10).

c. Do equipment setting/standardization/setup (WP008 10), except as below:

(1) Use two 0°, 0.500 inch diameter, 2.25 MHz, contact delay line search units for all areas except splice plate areas.

(2) For splice plate areas on horizontal stabilator, use two 0°, 0.500 inch diameter, 1 MHz, contact delay line search units.

(3) Use P-1 calibration point of graphite epoxy skinned honeycomb core sandwich assembly reference standard (WP008 10).

(4) Make sure correct response is being received by removing microdot cable from R BNC jack and observing total disappearance of received response.

### 16. Inspection Procedure For Skin to Core Areas.

■ See figures 6, 7, 8, and 9.

a. Do inspection procedure (WP008 10), except as below:

(1) Use two 0°, 0.500 inch diameter, 2.25 MHz, contact search units for all areas except splice plate areas.

(2) For splice plate areas on horizontal stabilator, use two 0°, 0.500 inch diameter, 1 MHz, contact search units.

(3) Make sure initial pulse width does not interfere with location of received response. If required, use different search unit on receiver cable.

(4) For splice plate areas, scan parallel to steps. Decrease in response peak amplitude may occur when crossing steps. Examples of response from good and delaminated areas are shown in figure 10, CRTs 1 and 2.

(5) Mark all areas with aircraft marking pencil where through transmission received response drops below 5 percent of received response is shifted more than 1-1/2 large division on CRT horizontal baseline. For examples of flaw responses, (WP008 10).

(6) Use ultrasonic pulse-echo method (WP008 13) to determine if above marked area, substep (5), is result of skin delamination. Do pulse-echo inspection of both surfaces to help identify location of flaw causing through transmission unbond response. Use figure 1 to identify skin thickness in marked areas.

## NOTE

Equipment differences may require use of alternate REP. RATE, DAMP., FREQ., GAIN, and HORIZONTAL SWEEP DELAY and LENGTH.

### 17. Equipment Settings/Standardization/Setup

#### For Filled Area. Do Equipment

Settings/Standardization/Setup, General including initial equipment settings, (WP008 11), except; use 0°, 0.375 inch diameter, 2.25 MHz, contact delay line search unit.

## NOTE

Following completion of general setup, initial pulse leading edge should be located at 0 on the CRT horizontal baseline. See figure 12, CRT 1.

### 18. Inspection of Filled Area.

a. Outline inspection area with aircraft marking pencil. For inspection area, figure 11.

b. Apply couplant to one side of inspection area.

c. Position search unit on inspection area and adjust COARSE GAIN so reflected response is similar to figure 12, CRT 1.

d. Scan area to be inspected and use finger damping on back surface of inspection area. Place

couplant on end of finger and touch opposite surface of inspection area beneath search unit. As finger touches surface and is removed, reflected responses will move up and down, damp, on CRT indicating good bond.

e. Unbond or delamination on search unit side of inspection area will cause loss of reflected signal on CRT, see figure 12, CRT 2.

f. Unbond or delamination on surface opposite search unit will result in no movement of reflected signal on CRT, see figure 12, CRT 3.

g. Mark all areas with aircraft marking pencil where reflected response is lost, figure 12, CRT 2, or cannot be damped, figure 12, CRT 3.

h. Use ultrasonic pulse-echo method to determine if above marked area is result of skin delaminations (WP008 13). See figure 7 to identify skin thickness in area marked.

#### 19. Equipment Settings/Standardization/Setup

**For Skin To Closure Area.** For skin to closure bondline at leading edge, see figure 13, do Equipment Settings/Standardization/Setup for Model 80 Fokker Bond Tester (WP008 06), except as below:

a. Set bond tester front face settings:

DSP .....	ACTIVATED
MODE .....	M
S (SWEEP RATE) .....	1
R (SWEEP RANGE) ....	5
F (FREQUENCY	
BAND) .....	5

#### NOTE

It is important to use correct amount of couplant. Not enough couplant will give incorrect response.

b. Apply couplant to skin to core area shown in figures 13 and 14.

c. Position probe on skin to core area.

d. Use FREQ., FINE, and GAIN to get unbond A-scale response of  $0 \pm 1$  KHz and B-scale response of approximately 100. See figure 14, display 1.

e. Reposition probe over known nearby good bond area and observe good bond response. For this procedure, typical good bond response has A-scale display between -20 and -40 KHz and B-scale of 122, B-scale maximum, see figure 14.

#### 20. Inspection Procedure For Skin To Closure

**Area.** For skin to closure bondline at leading edge, do Inspection Procedure (WP008 14), except as below:

a. Outline inspection area with aircraft marking pencil, see figure 13.

b. Apply couplant to inspection area. Use distilled water if leading edge of skin is open to edge.

c. Position probe on upper or lower surface of inspection area.

## NOTE

When abnormal amount of fairing material or metal strap doubler has been used in skin to closure area, delete inspection in this area. Abnormal amount of fairing material is indicated by A-scale air response even with correct coupling.

d. Inspect skin to closure bondline by monitoring A-scale numeric display. Maintain good coupling because air responses will appear similar to unbond response. Use scan index of 3/16 inch or half probe diameter.

e. Areas displaying A-scale response of -5 KHz through 5 KHz indicate unbond.

f. Mark all unbond response areas with aircraft marking pencil.

## WARNING

Cleaning compound is flammable liquid and vapor. May cause allergic respiratory and skin reaction. May cause eye, skin and respiratory irritation. Keep away from heat, sparks, and flame. Do not breathe dust (vapor, mist, gas). Use only with enough ventilation. Keep container closed. Avoid contact with eyes, skin and clothing. Wash thoroughly after handling.

**21. POST INSPECTION CLEANING AND CORROSION CONTROL.** Clean couplant and markings from inspection area using cleaning cloth moistened with cleaning compound. Allow to air dry for 15 minutes. ■

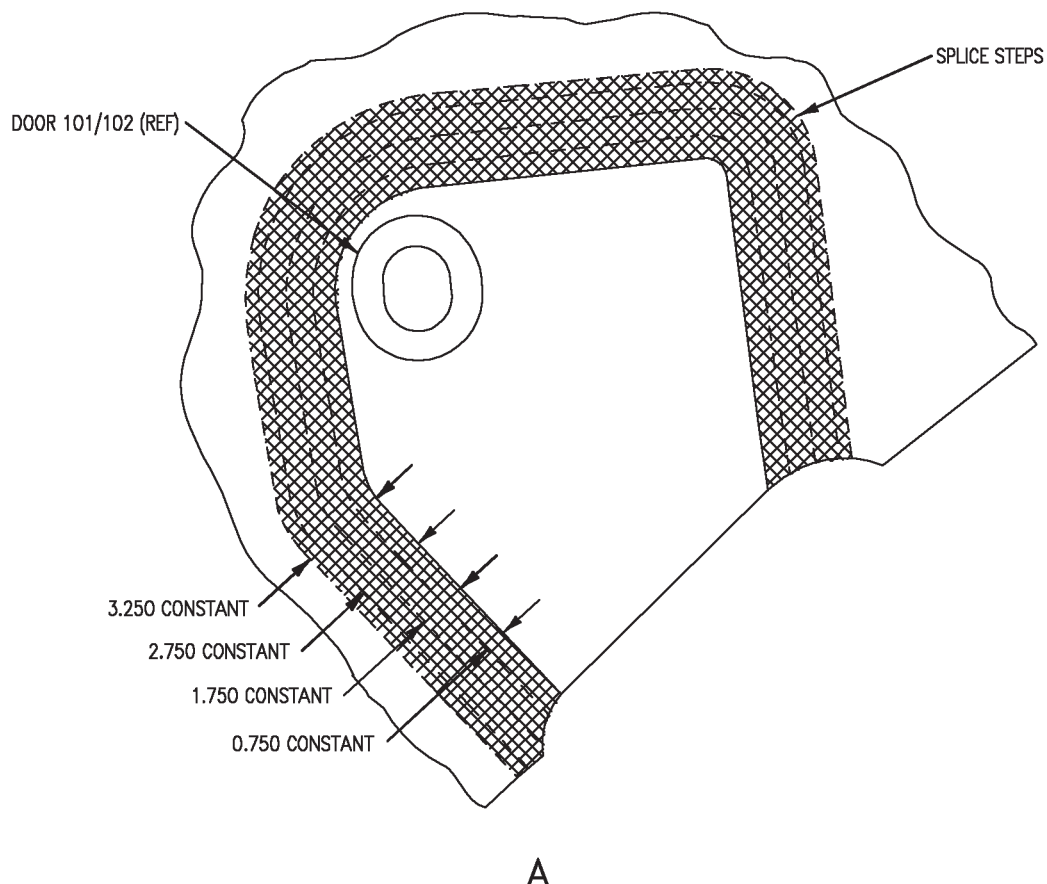
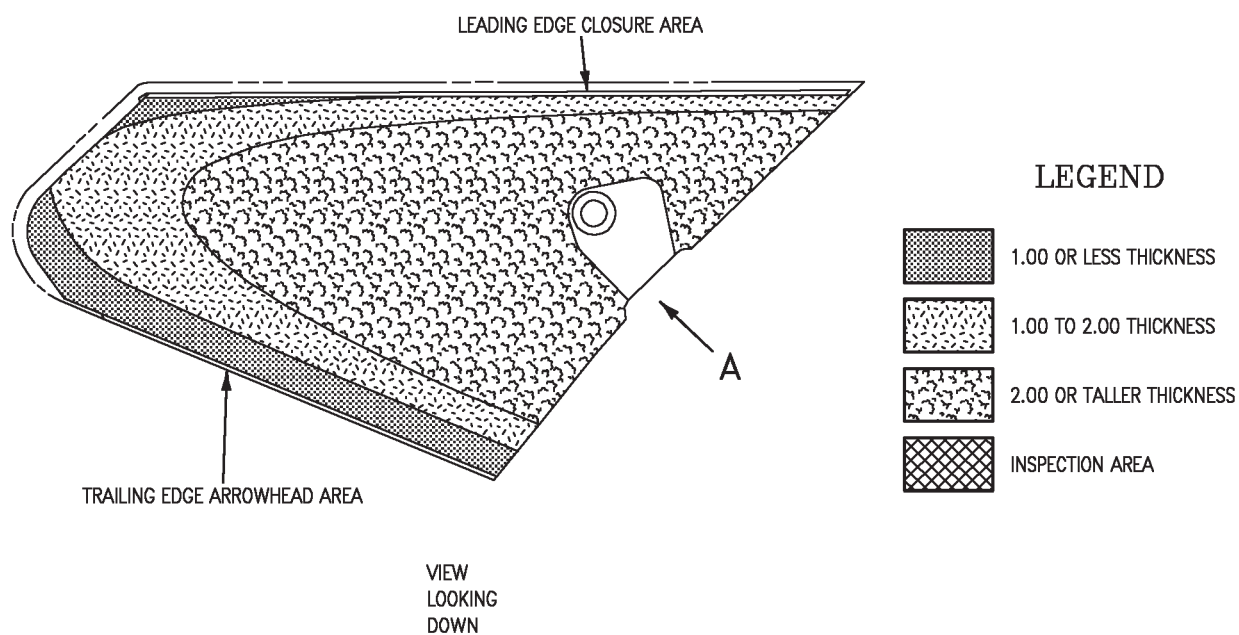


Figure 1. Horizontal Stabilator Inspection Areas and Internal Structure (Sheet 1)



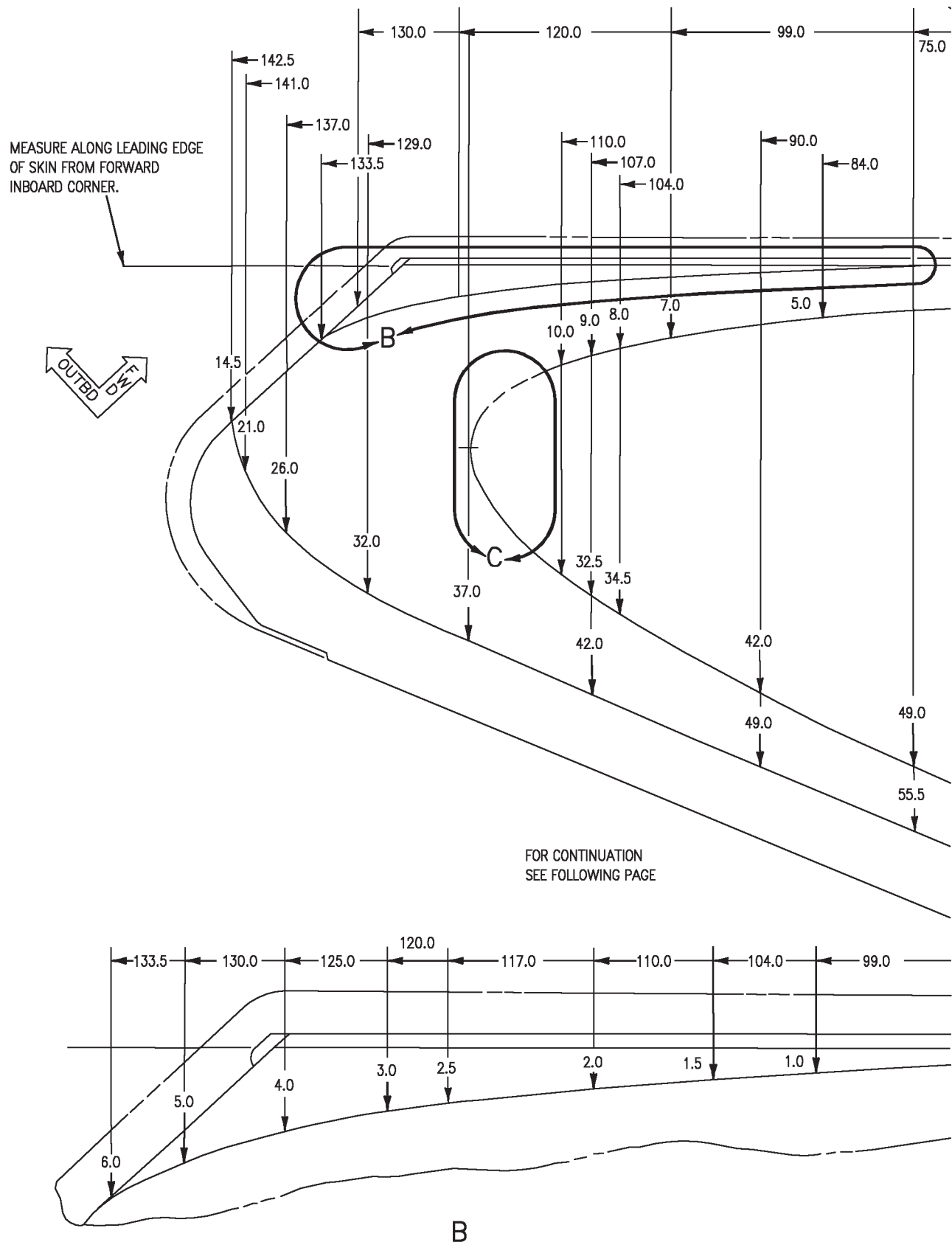


Figure 1. Horizontal Stabilator Inspection Areas and Internal Structure (Sheet 2)

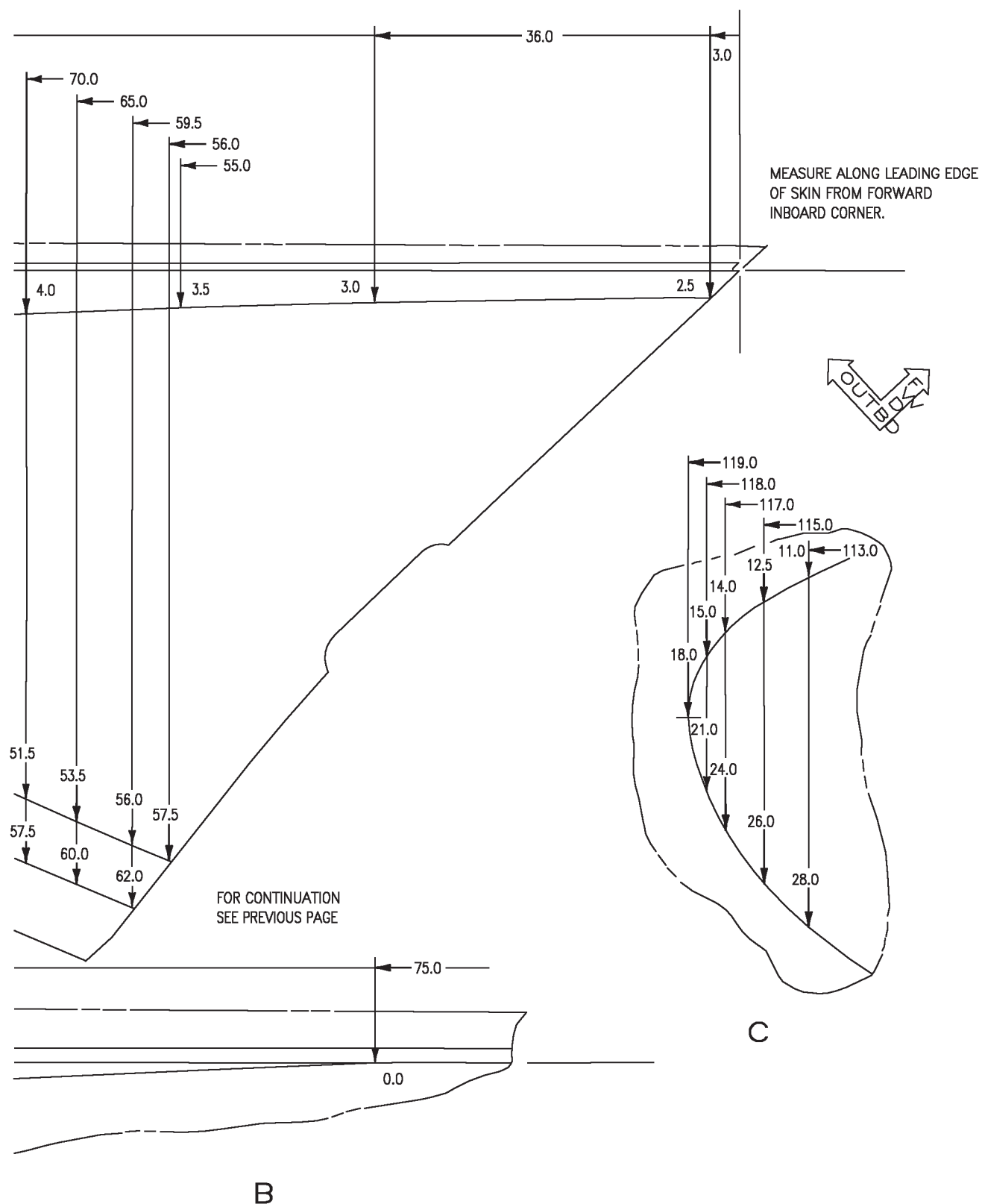


Figure 1. Horizontal Stabilator Inspection Areas and Internal Structure (Sheet 3)

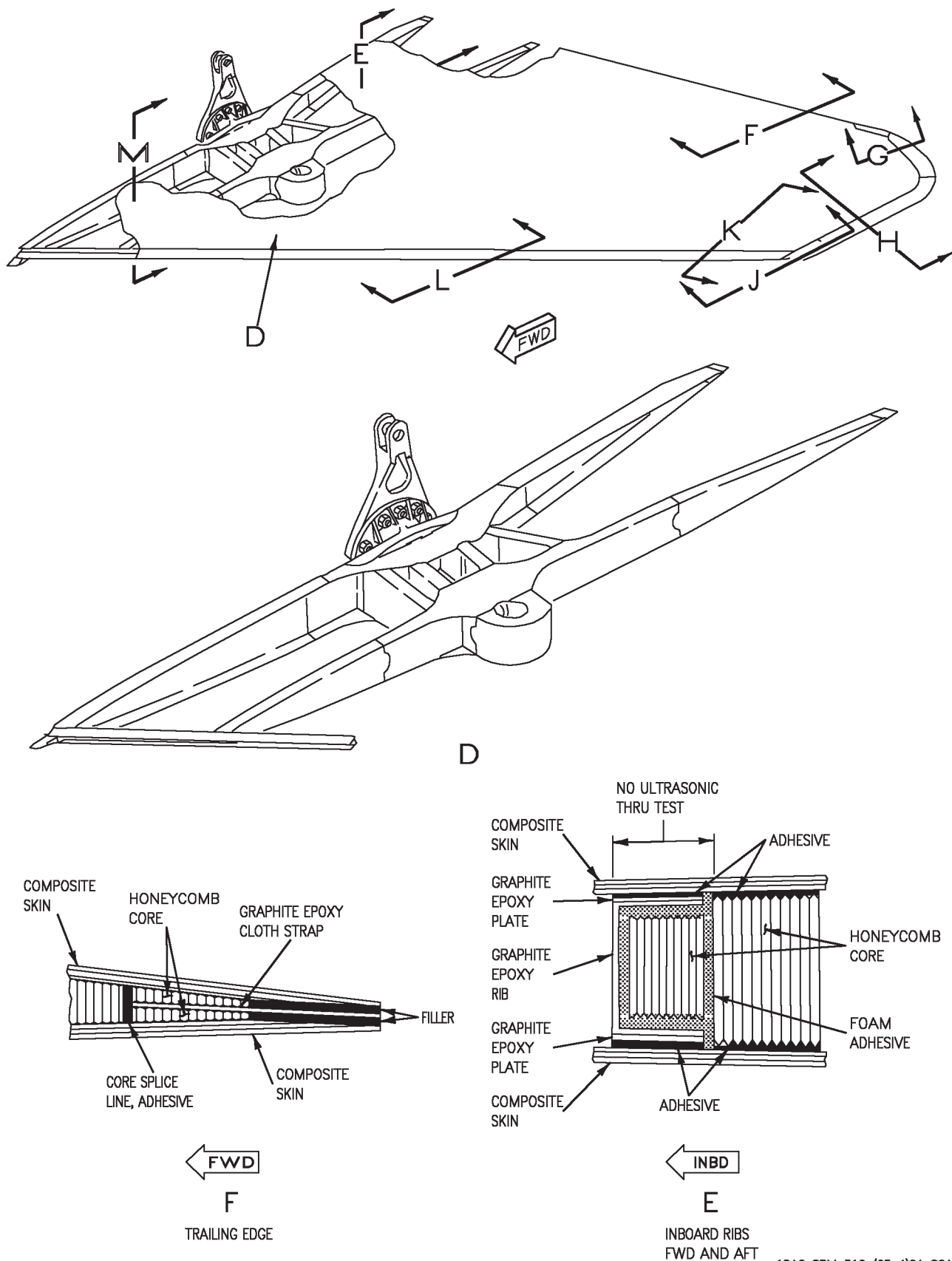
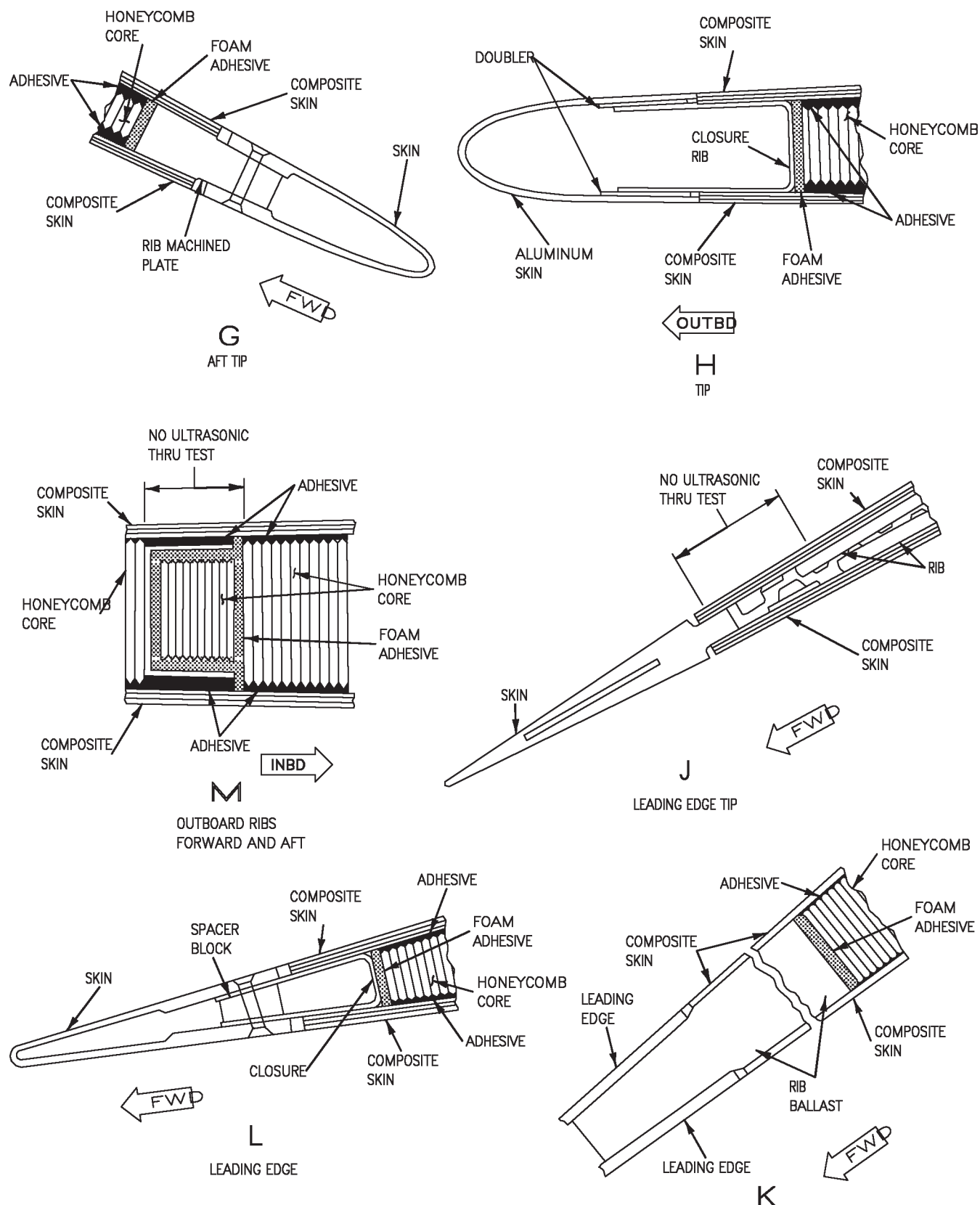


Figure 1. Horizontal Stabilator Inspection Areas and Internal Structure (Sheet 4)



**Figure 1. Horizontal Stabilator Inspection Areas and Internal Structure (Sheet 5)**

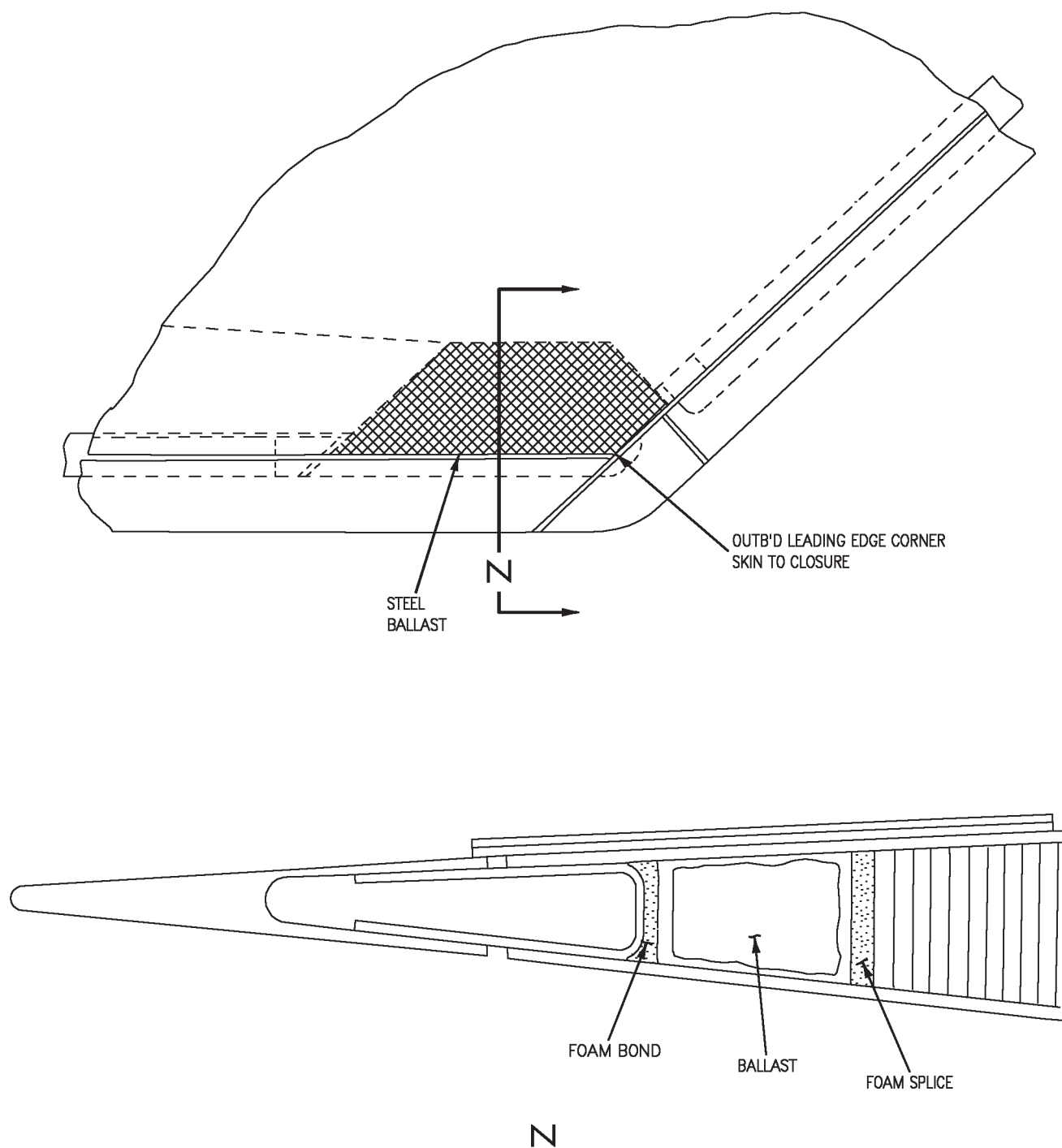


Figure 1. Horizontal Stabilator Inspection Areas and Internal Structure (Sheet 6)

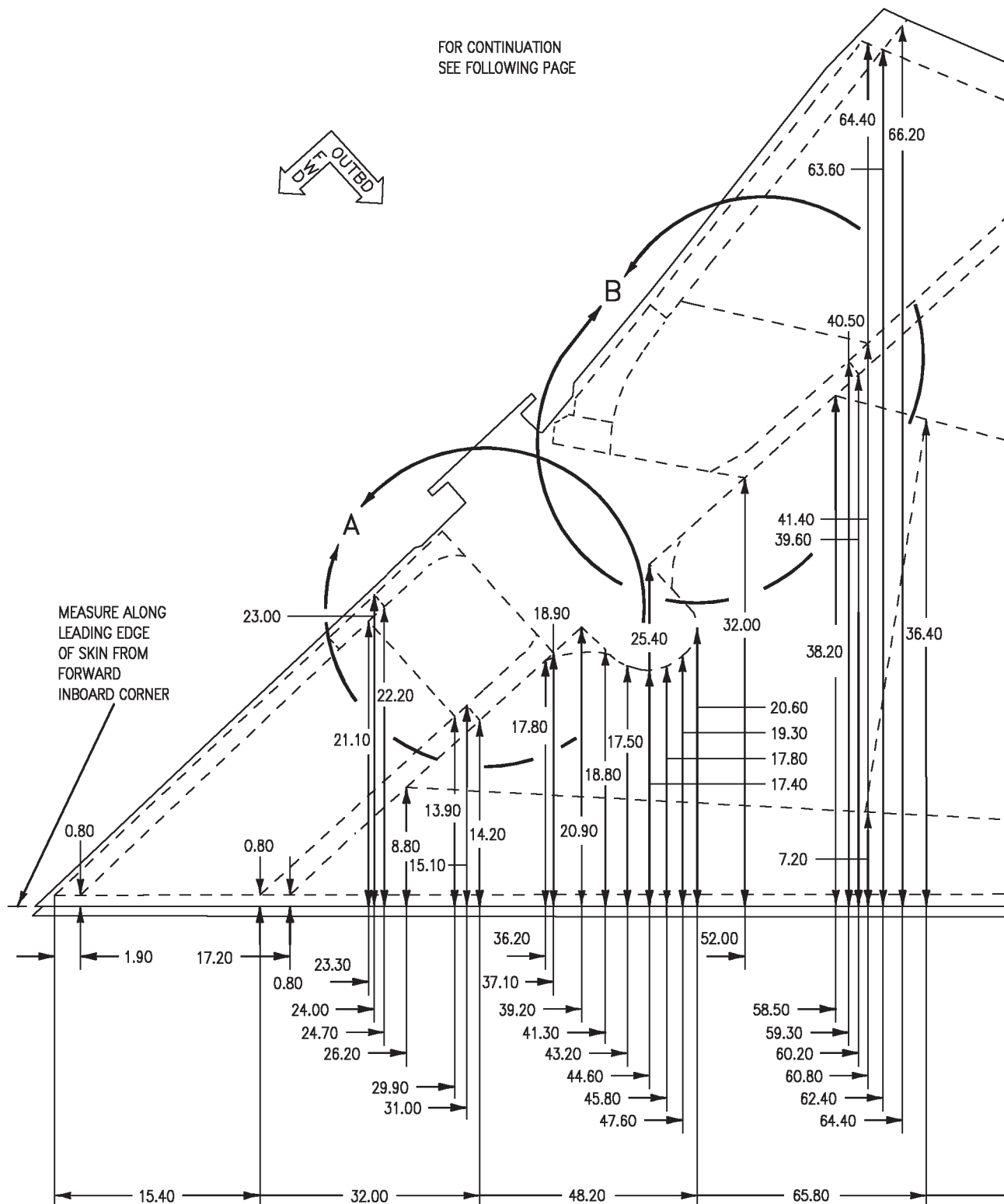


Figure 2. Core Splice Lines (Sheet 1)

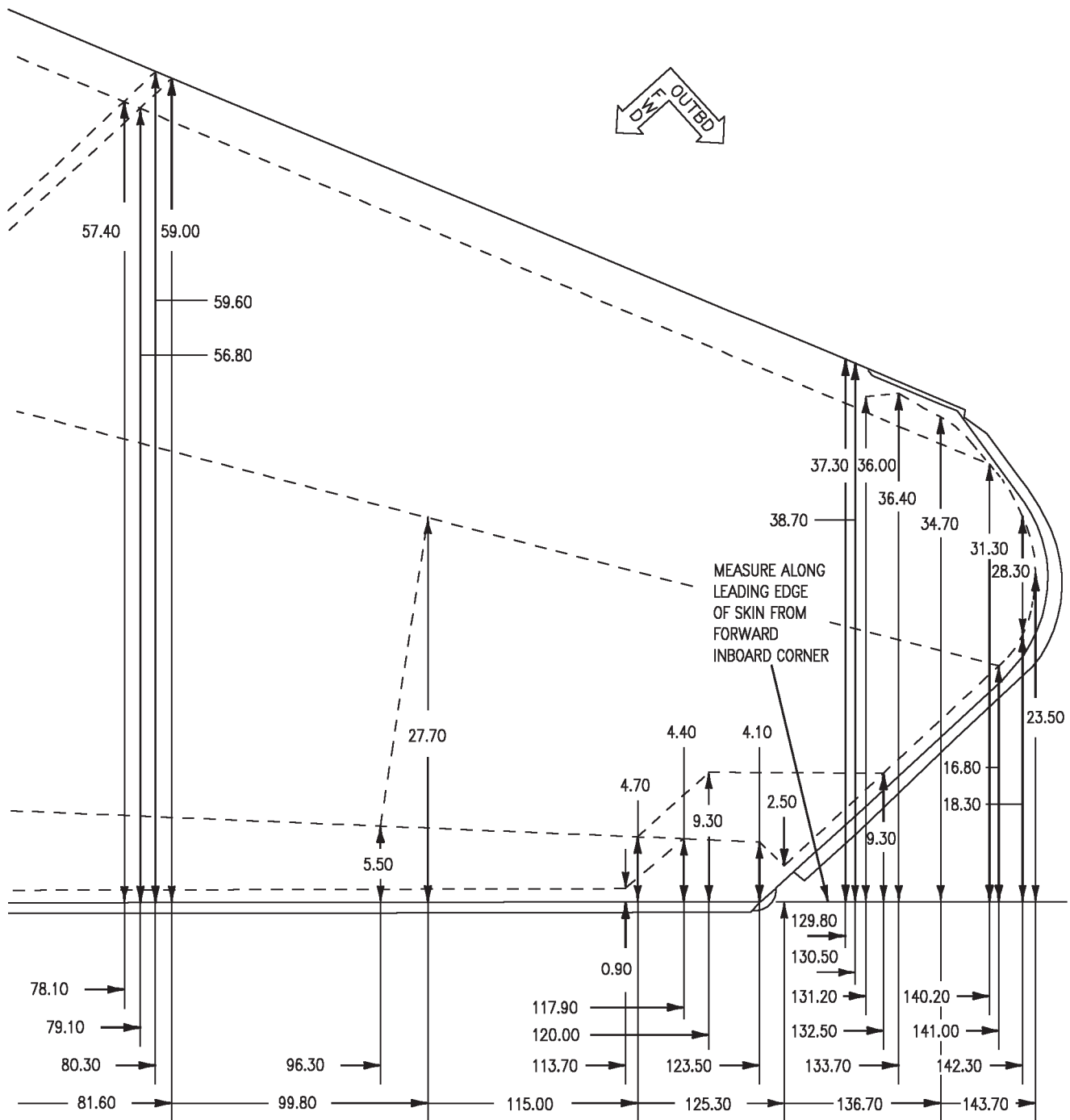
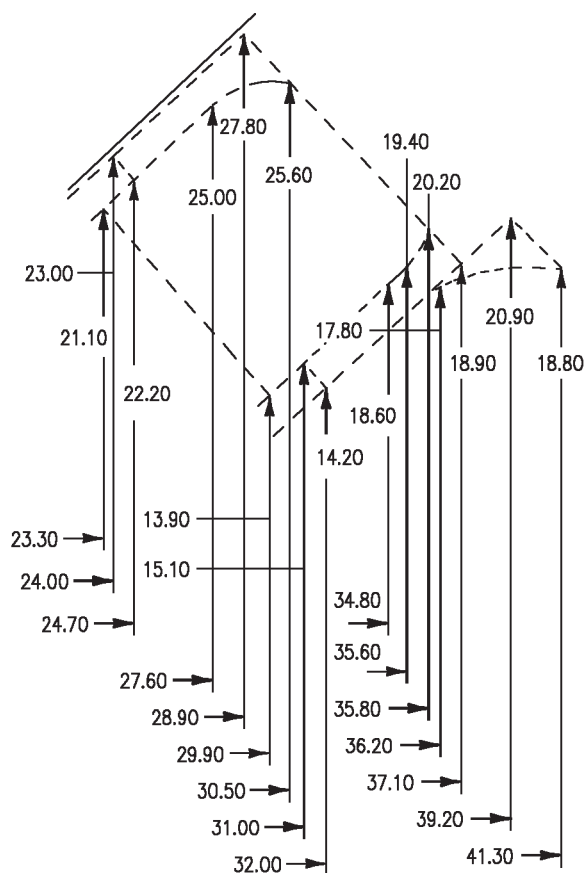
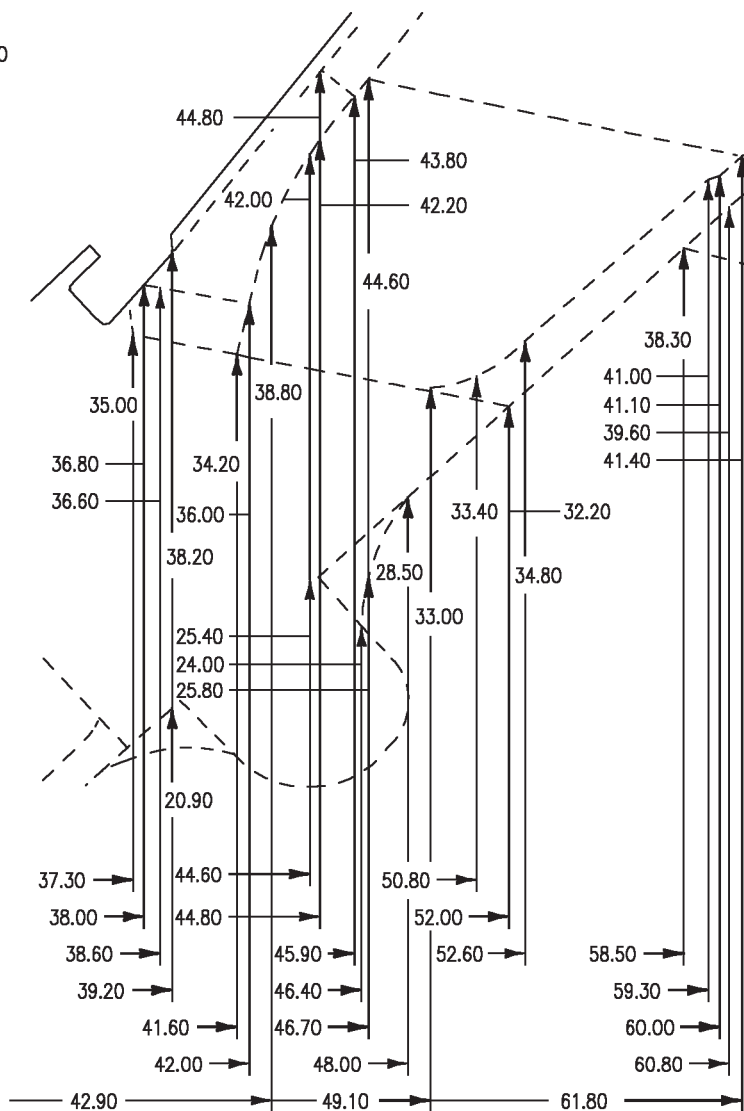


Figure 2. Core Splice Lines (Sheet 2)



A

MEASURE ALONG LEADING EDGE  
OF SKIN FROM FORWARD  
INBOARD CORNER.

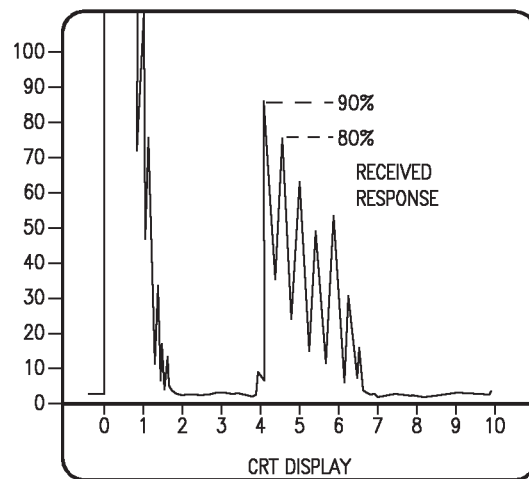
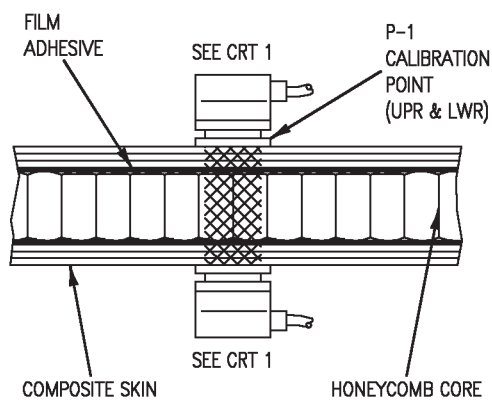


B

MEASURE ALONG LEADING EDGE  
OF SKIN FROM FORWARD  
INBOARD CORNER.

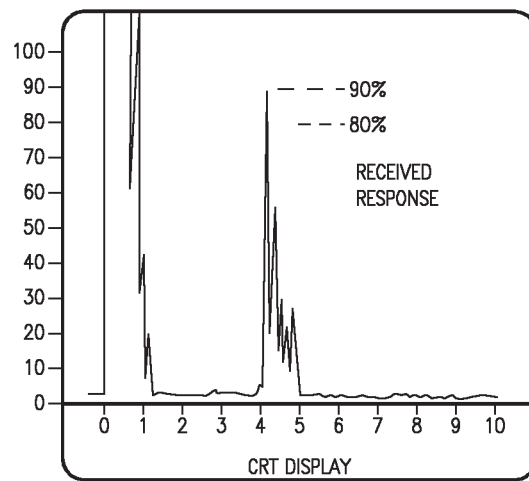
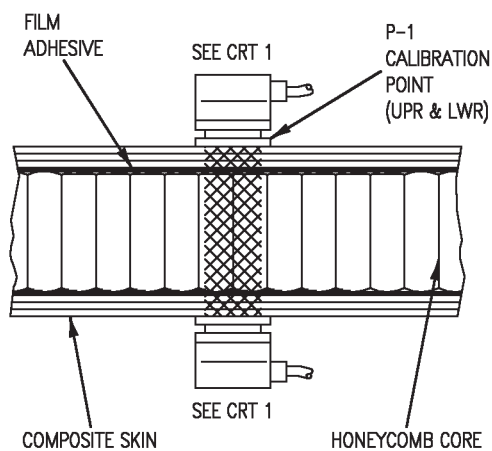
Figure 2. Core Splice Lines (Sheet 3)





CRT 1

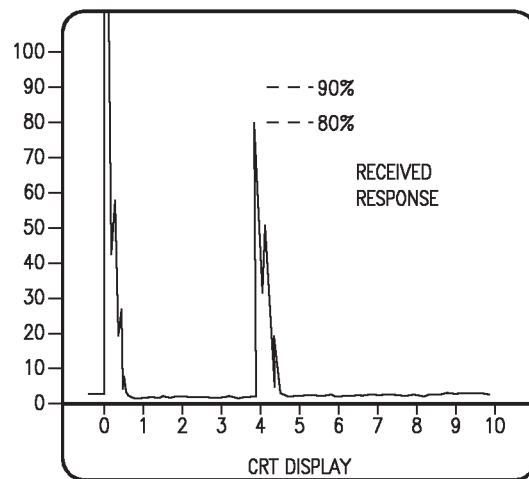
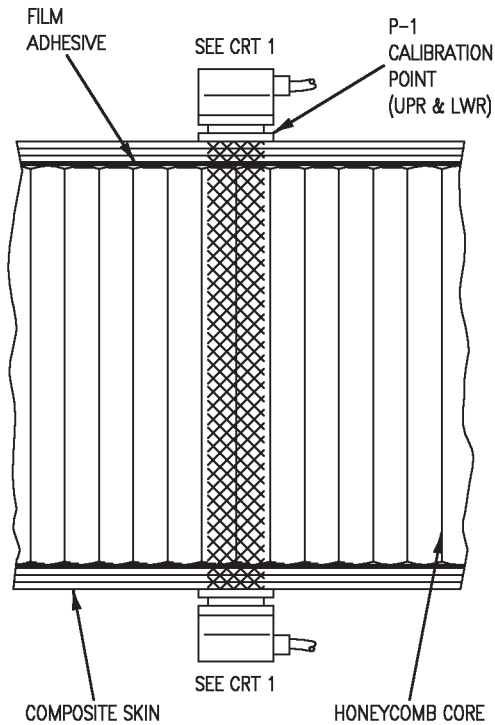
LEADING EDGE OF RECEIVED RESPONSE  
LOCATED AT 4 ON THE HORIZONTAL BASELINE.



CRT 1

LEADING EDGE OF RECEIVED RESPONSE  
LOCATED AT 4 ON THE HORIZONTAL BASELINE.

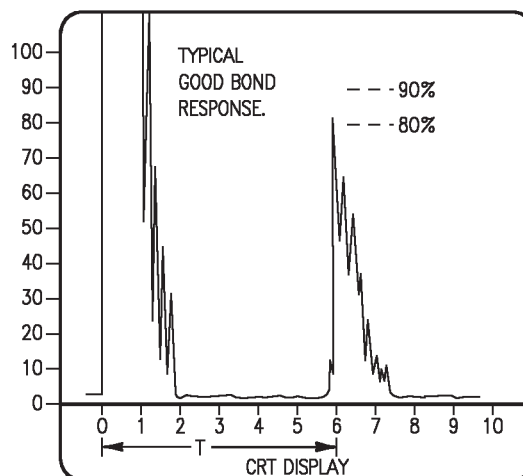
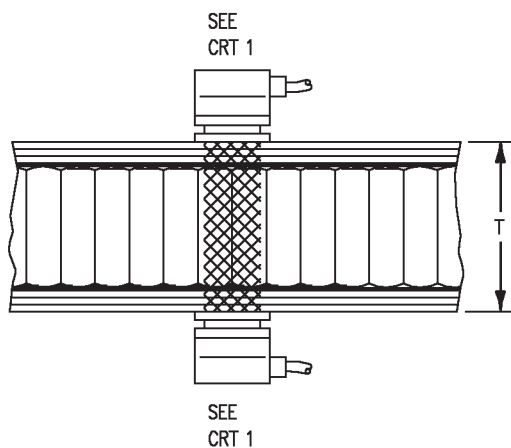
Figure 4. Standardization on 1 Inch Tall Honeycomb Core Reference Standard



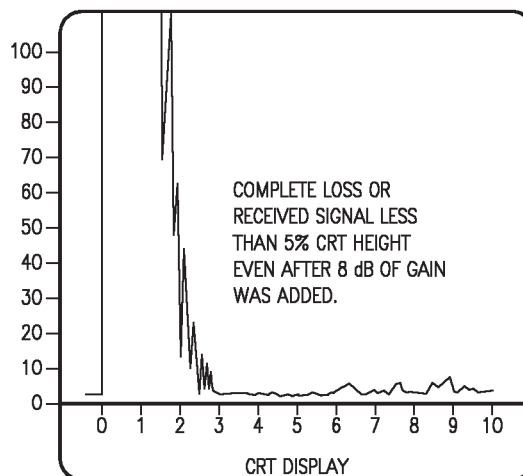
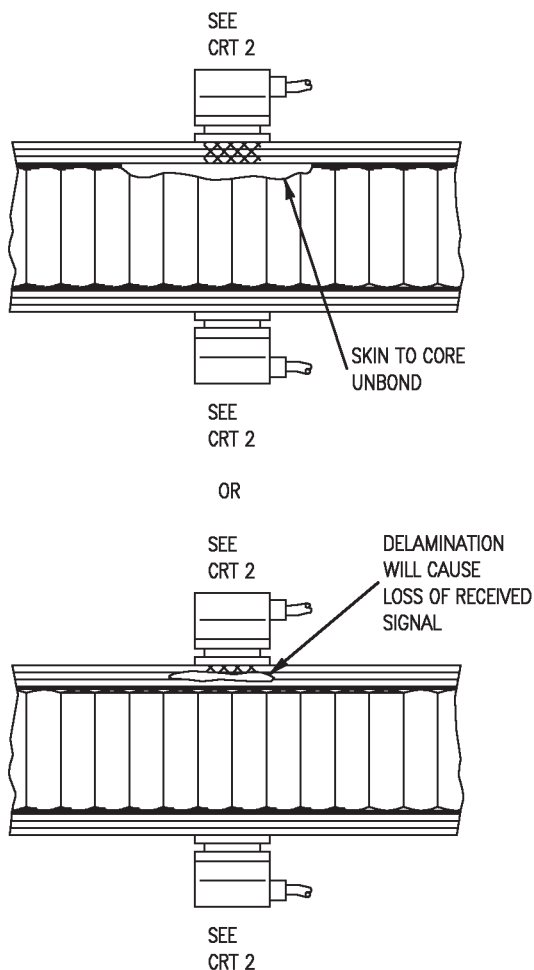
CRT 1

LEADING EDGE OF RECEIVED RESPONSE  
LOCATED AT 4 ON THE HORIZONTAL BASELINE.

Figure 5. Standardization on 3 Inch Tall Honeycomb Core Reference Standard



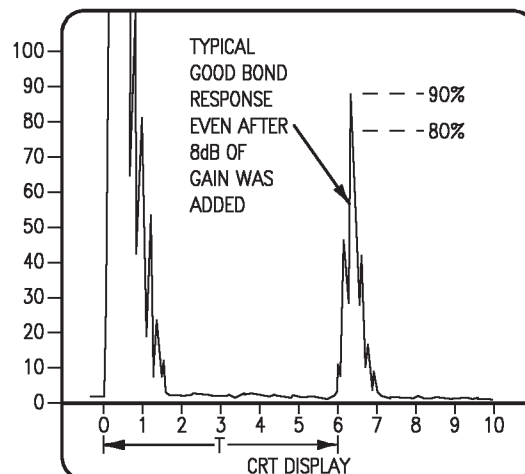
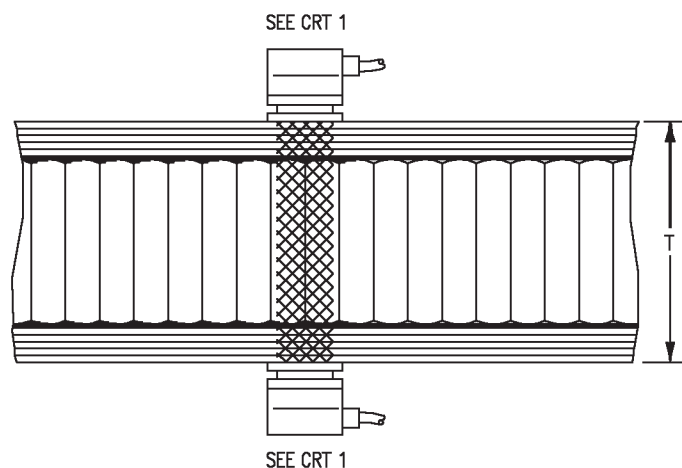
CRT 1



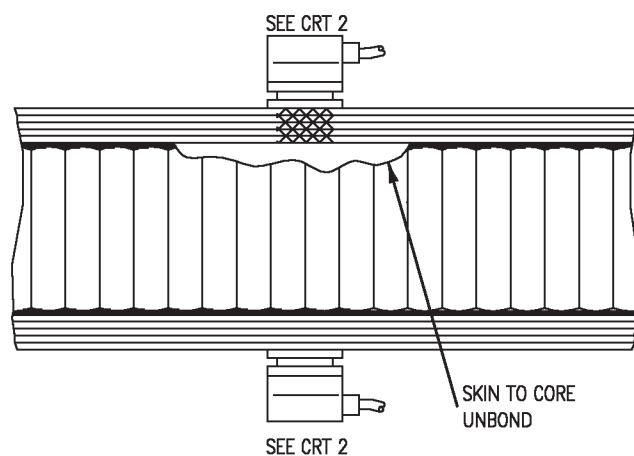
CRT 2

TYPICAL SKIN TO CORE AREA  
UNBOND RESPONSE.

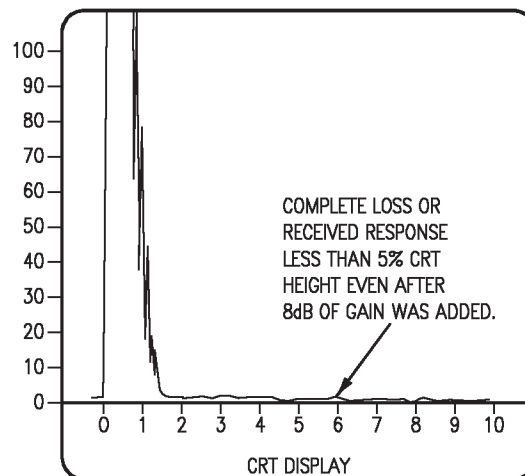
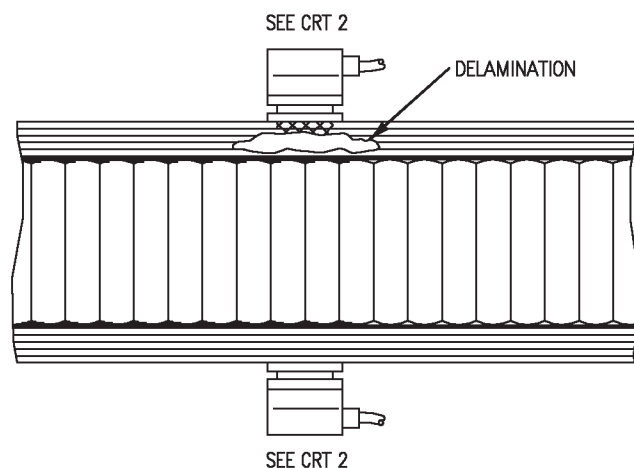
**Figure 6. Honeycomb Core Inspection Response In Areas Where Core Height is 1 Inch or Less**



CRT 1



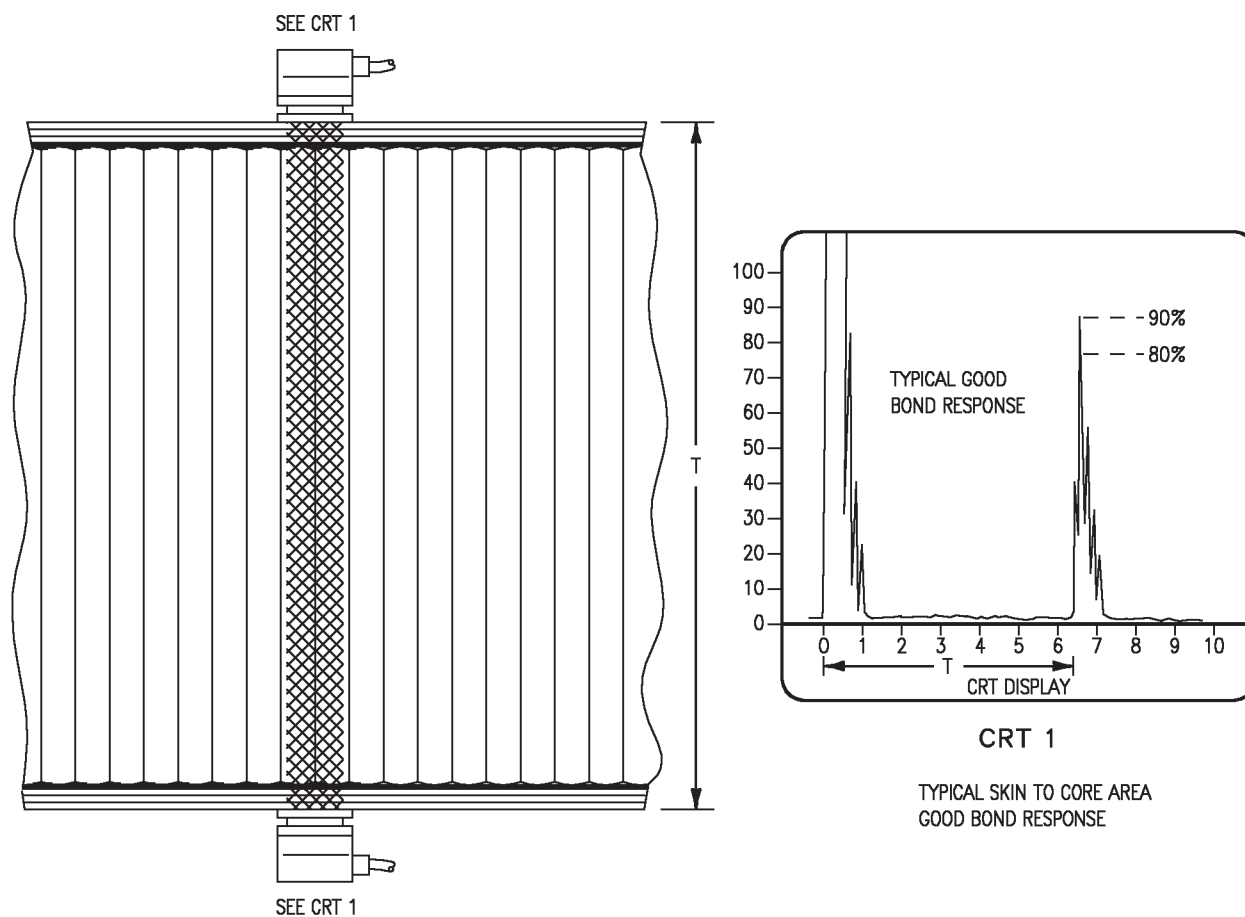
OR



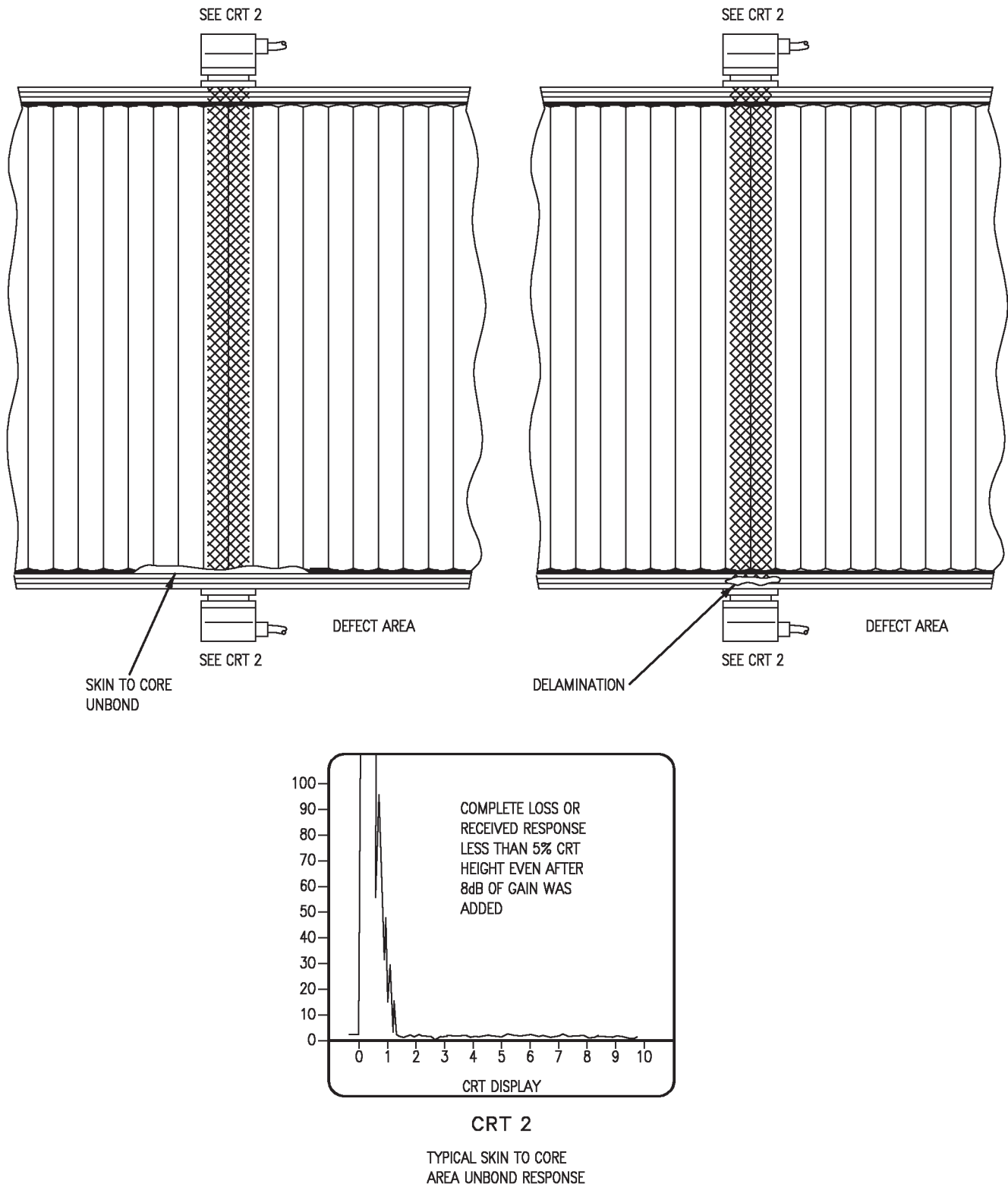
CRT 2

TYPICAL SKIN TO CORE AREA UNBOND RESPONSE

Figure 7. Inspection Procedures for 1 to 2 Inches Tall Honeycomb Core Areas



**Figure 8. Inspection Procedures for 2 Inches or Taller Honeycomb Core Areas (Sheet 1)**



**Figure 8. Inspection Procedures for 2 Inches or Taller Honeycomb Core Areas (Sheet 2)**

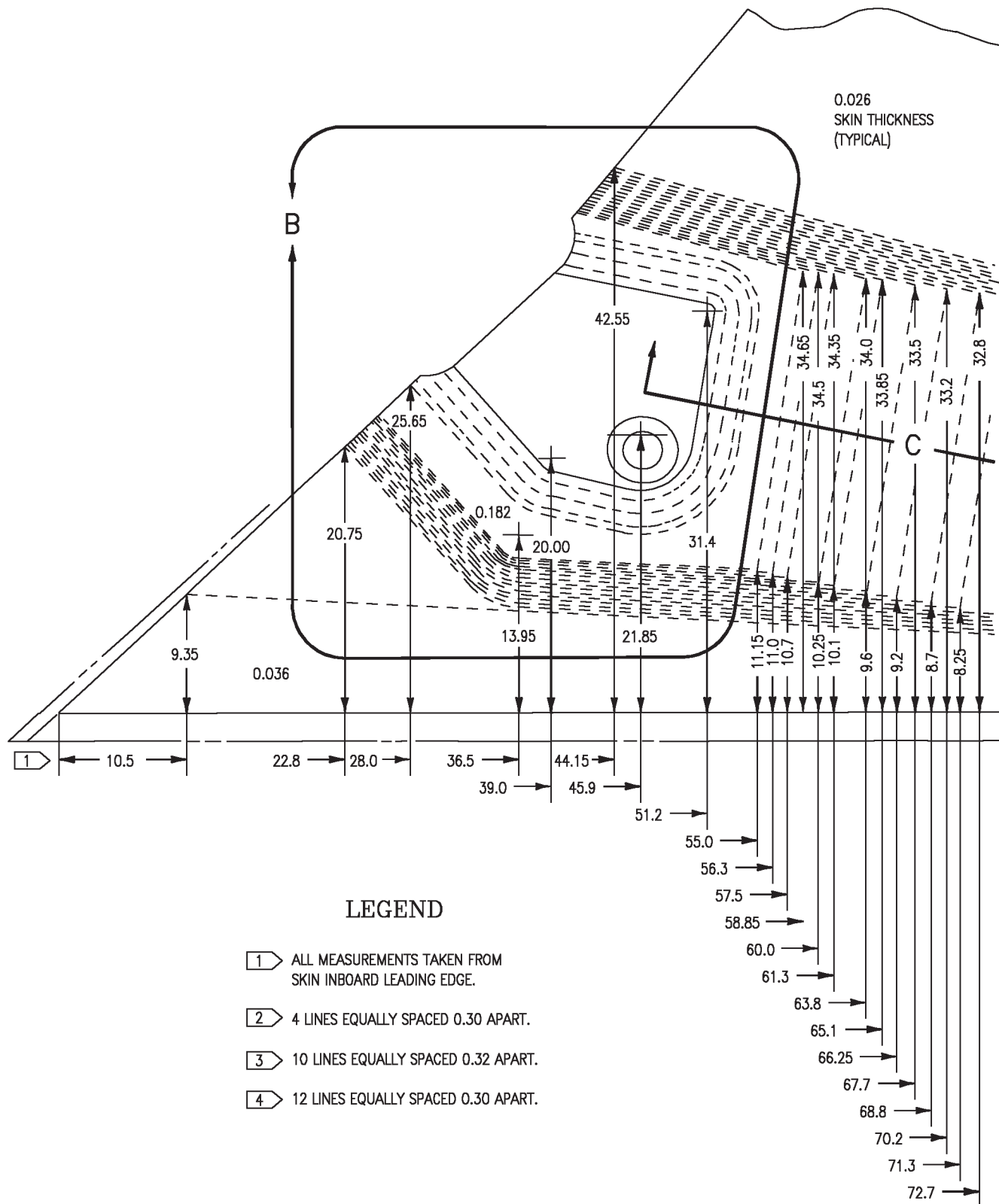


Figure 9. Composite Skin Thickness (Sheet 1)



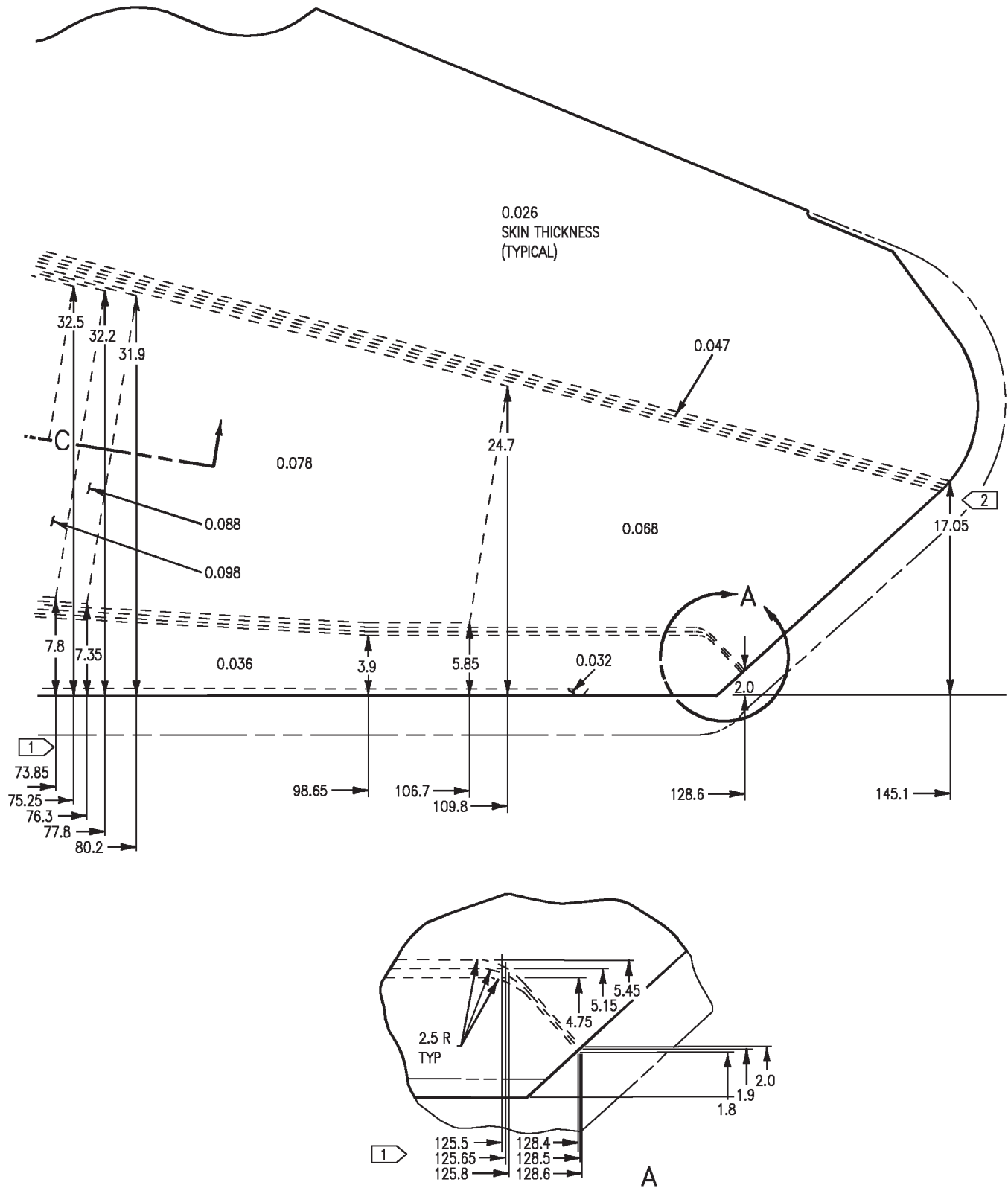
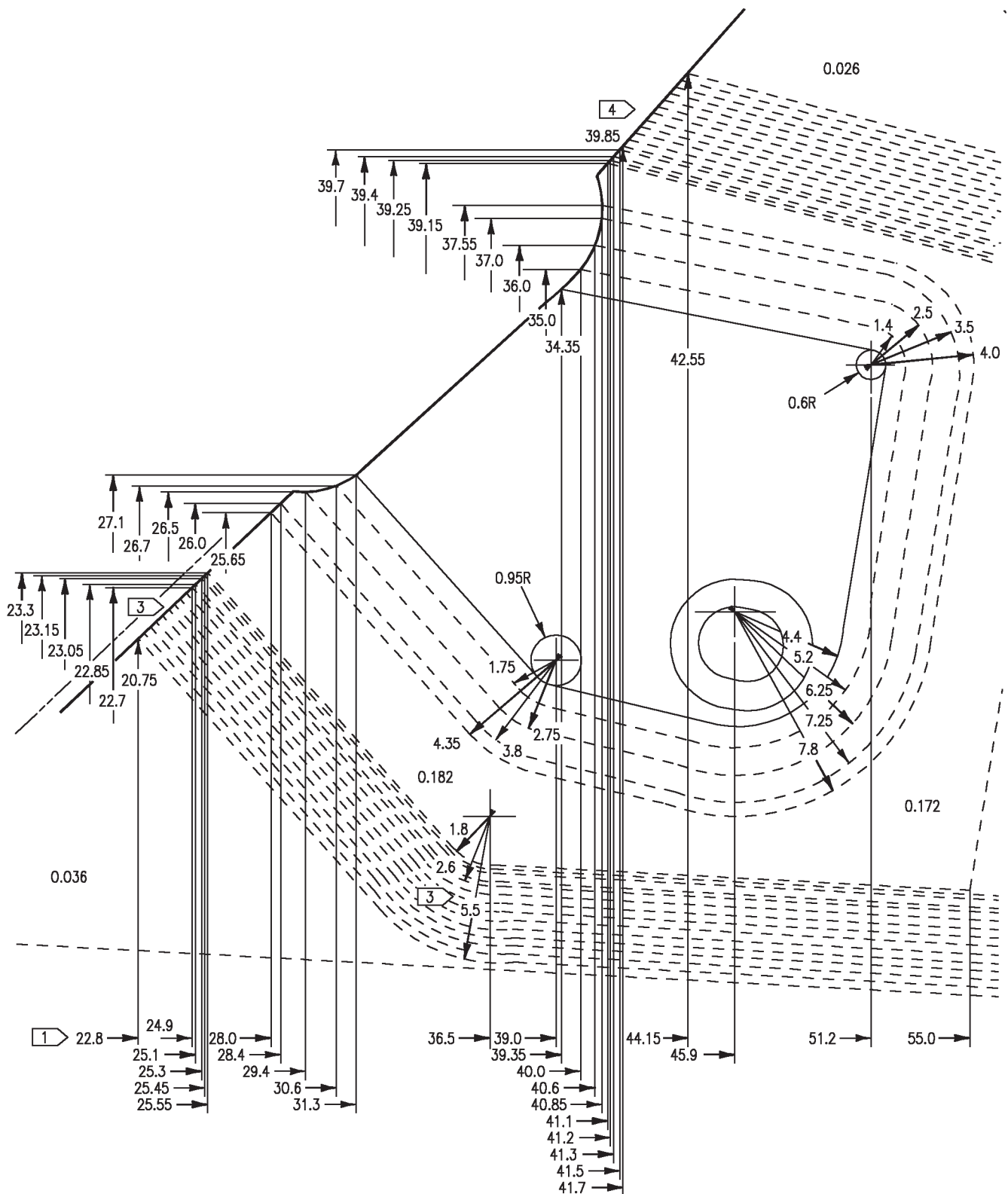
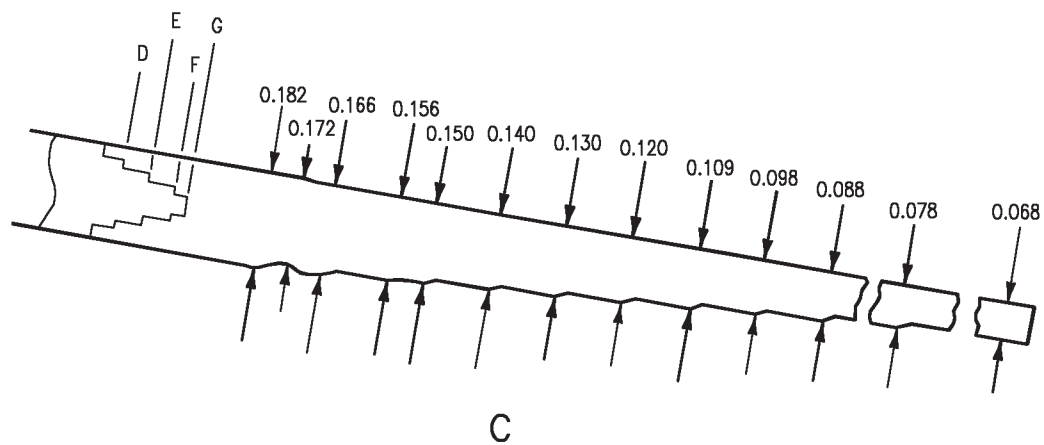


Figure 9. Composite Skin Thickness (Sheet 2)



B

Figure 9. Composite Skin Thickness (Sheet 3)



## LEGEND

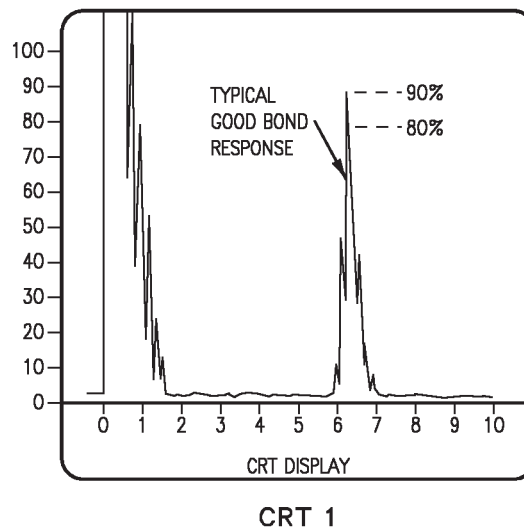
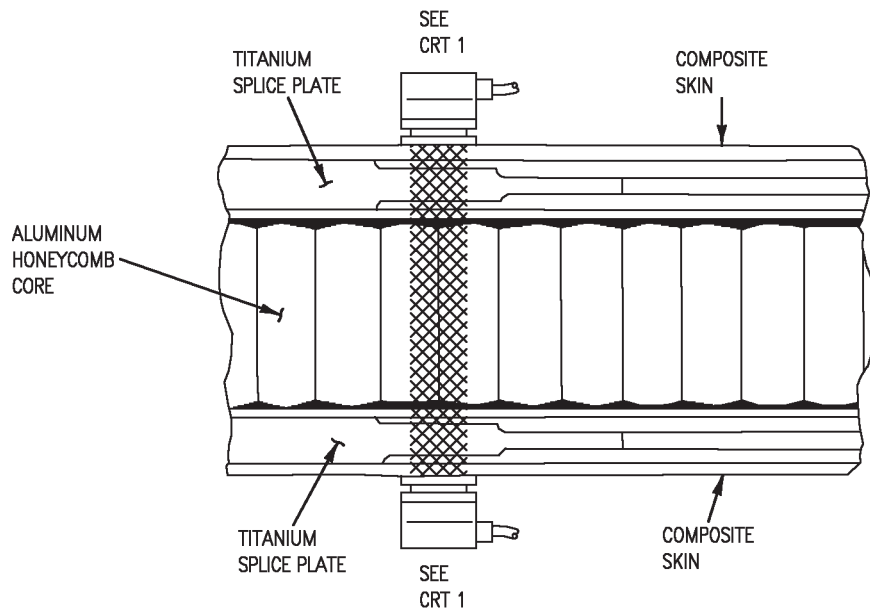
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E-0.0364

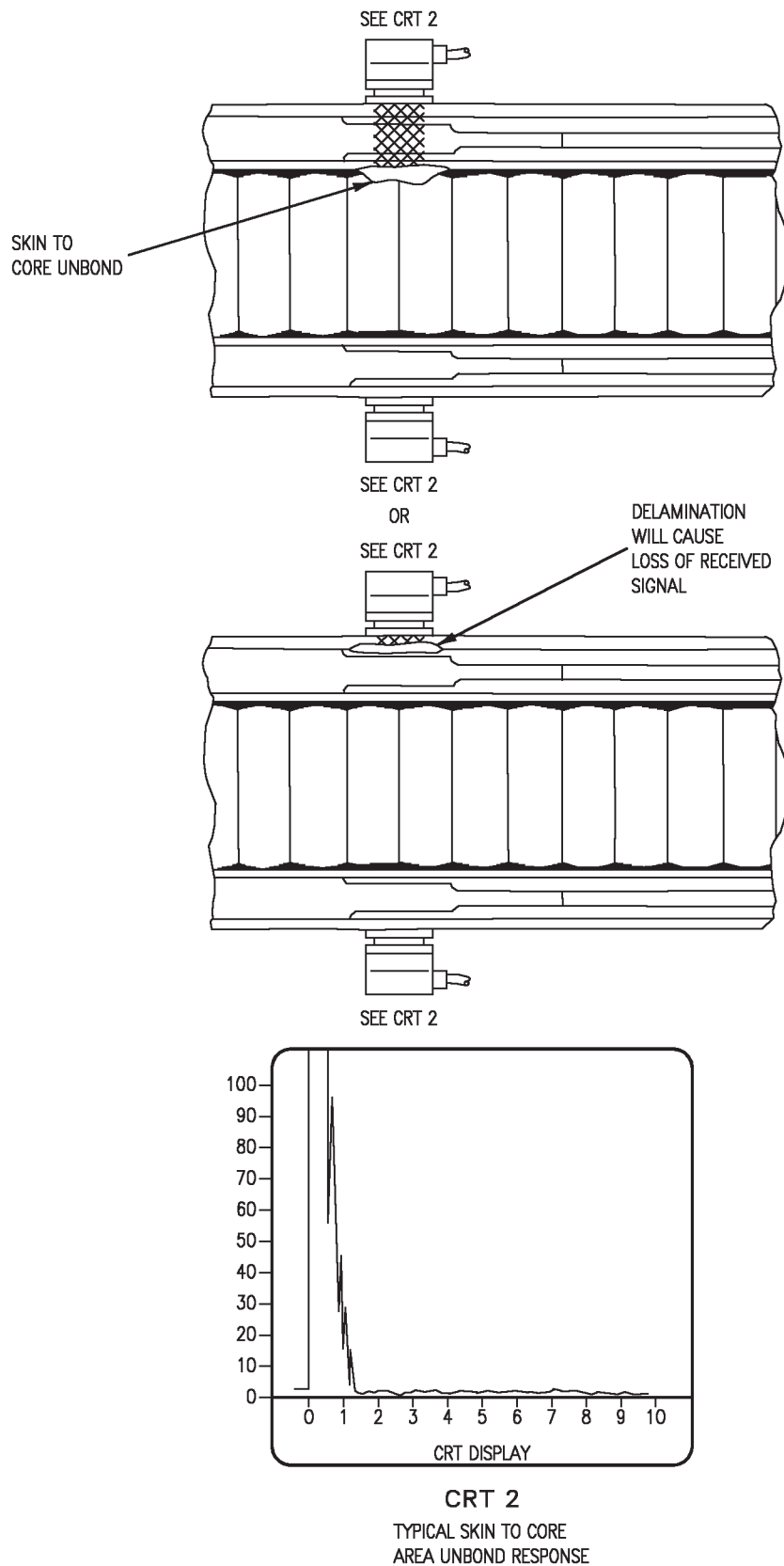
F-0.0520

G-0.0676

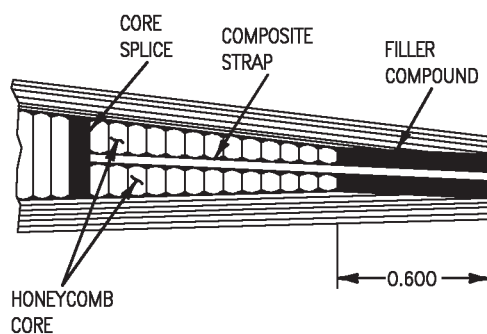
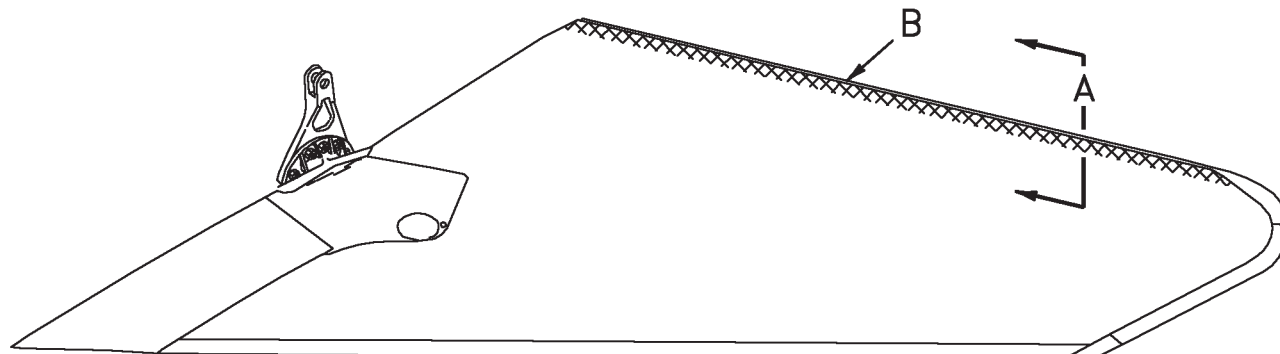
Figure 9. Composite Skin Thickness (Sheet 4)



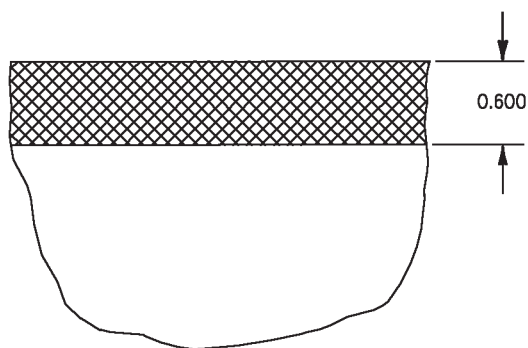
**Figure 10. Honeycomb Core Area Inspection at Splice Plate (Sheet 1)**



**Figure 10. Honeycomb Core Area Inspection at Splice Plate (Sheet 2)**



A



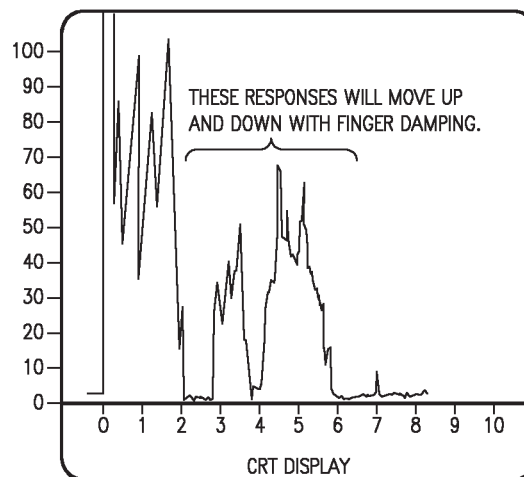
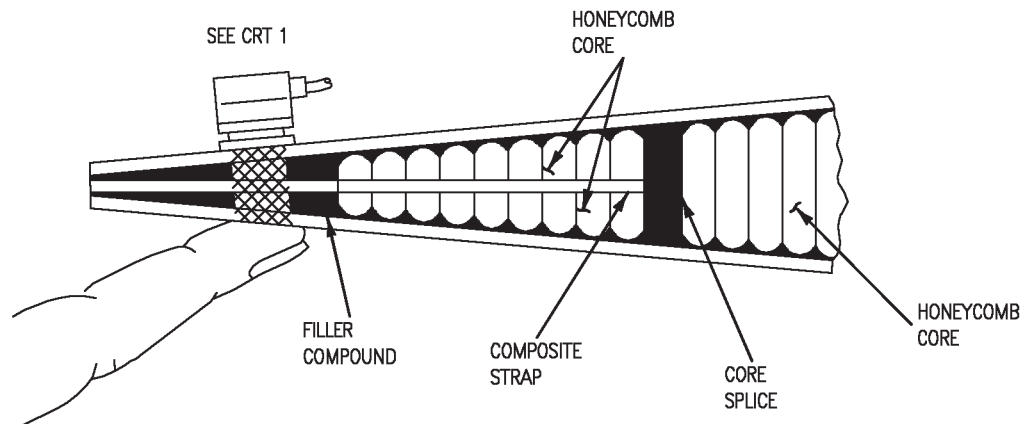
B

LEGEND



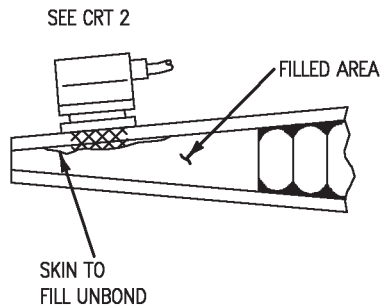
INSPECTION AREA

Figure 11. Trailing Edge Inspection Area

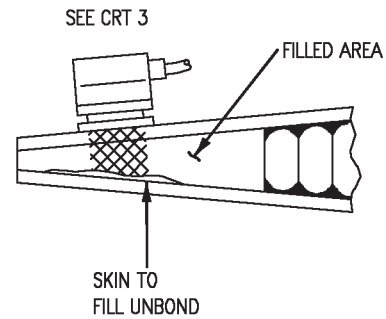
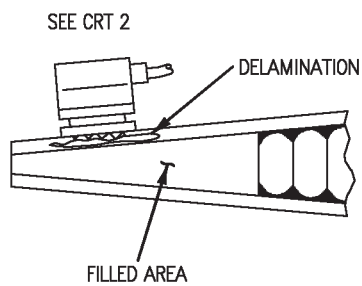


TYPICAL GOOD BOND RESPONSE

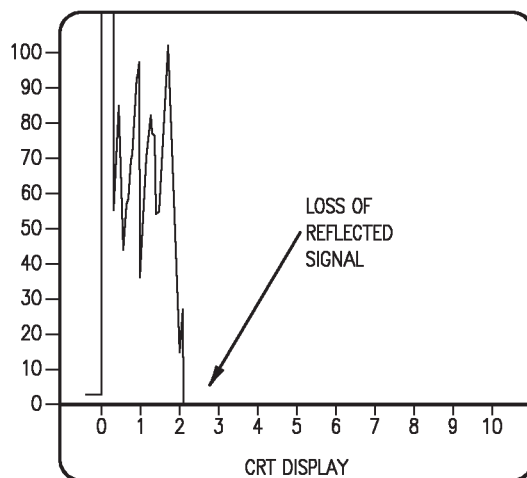
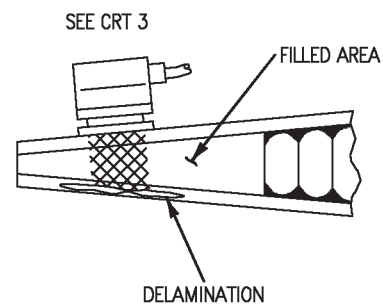
Figure 12. Ultrasonic Responses From Filled Area (Sheet 1)



OR

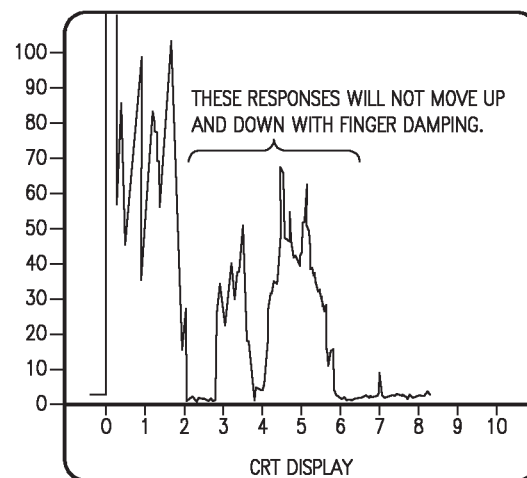


OR



**CRT 2**

UNBOND OR DELAMINATION ON SEARCH UNIT SIDE.



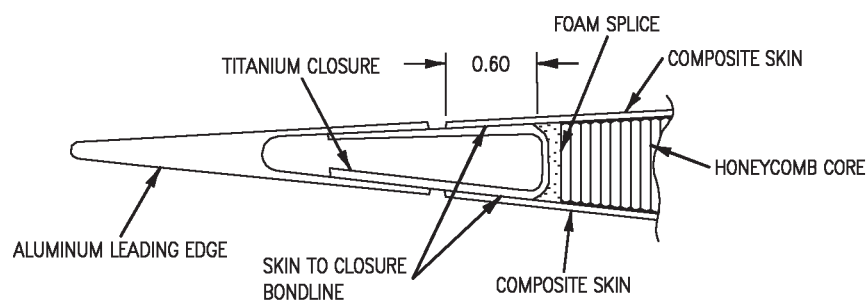
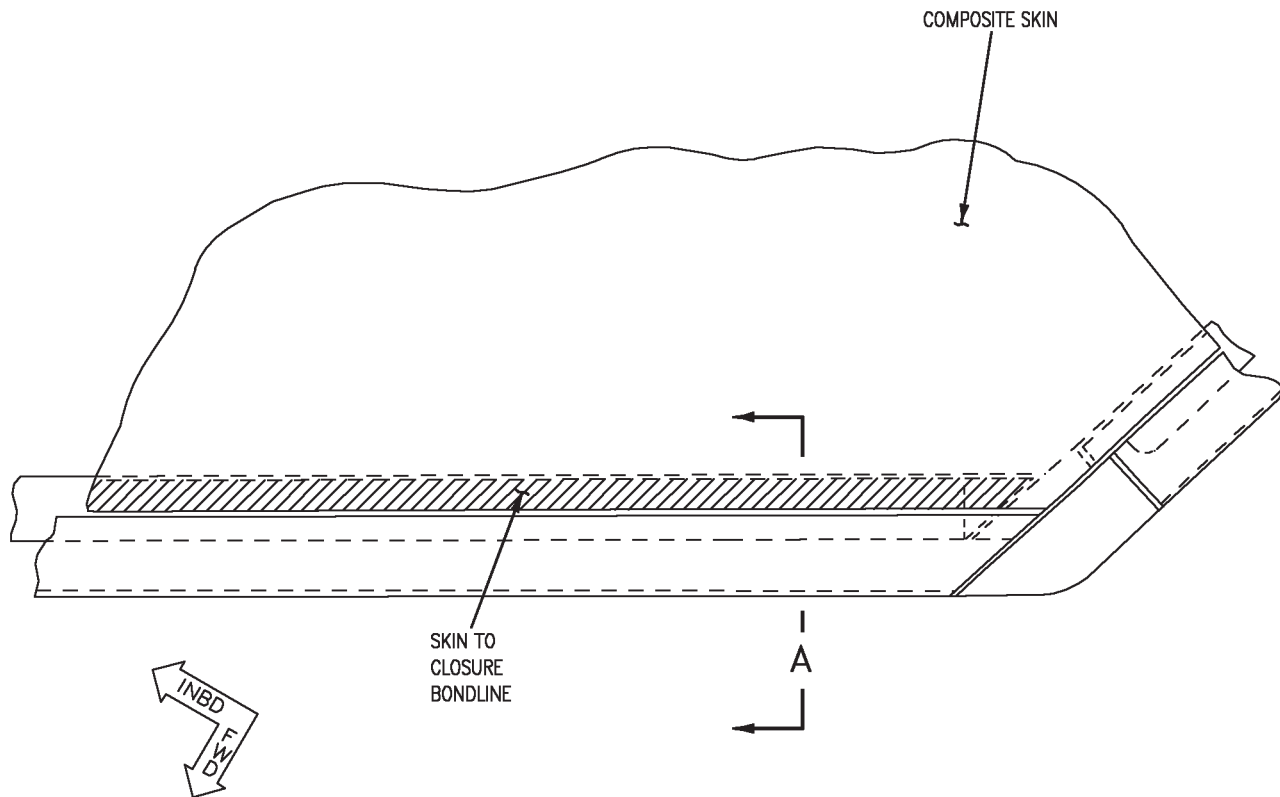
**CRT 3**

UNBOND OR DELAMINATION ON SIDE OPPOSITE SEARCH UNIT.

**Figure 12. Ultrasonic Responses From Filled Area (Sheet 2)**



7



A

LEGEND



Figure 13. Horizontal Stabilizer Leading Edge Closure (Sheet 1)

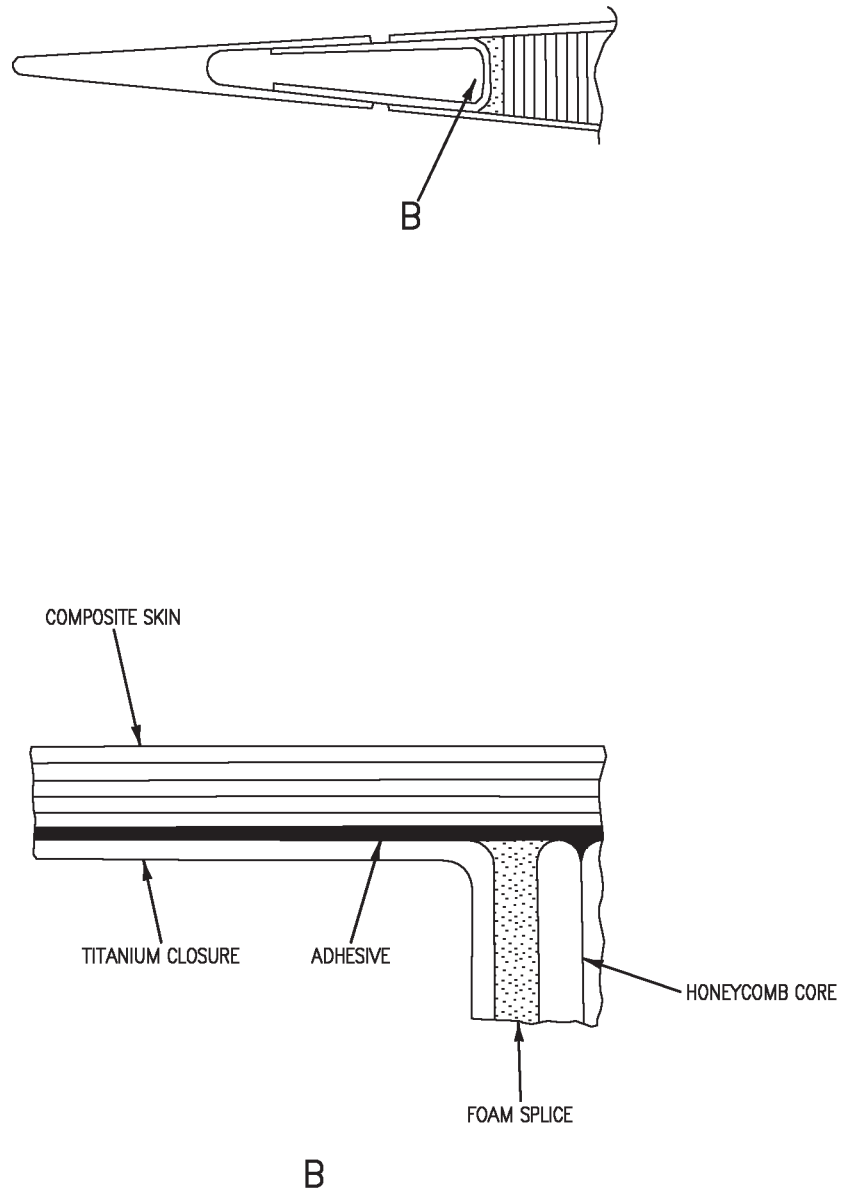
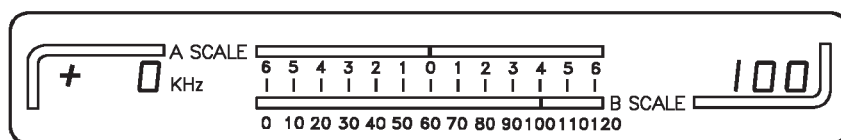
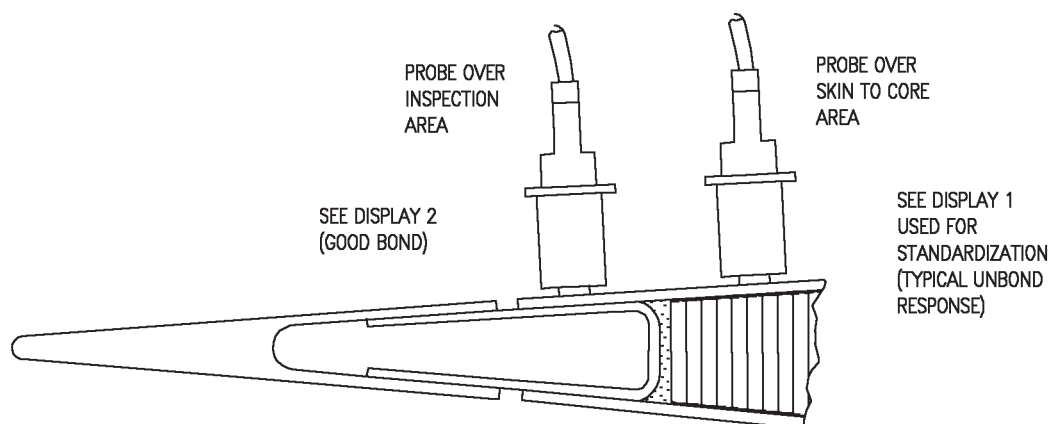
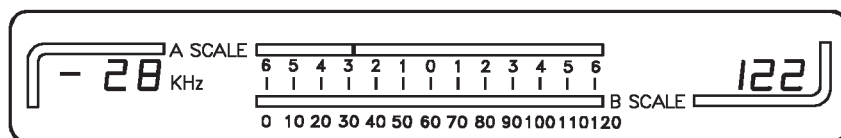


Figure 13. Horizontal Stabilizer Leading Edge Closure (Sheet 2)

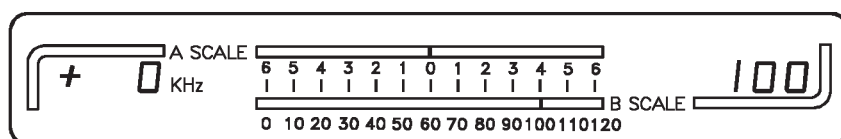
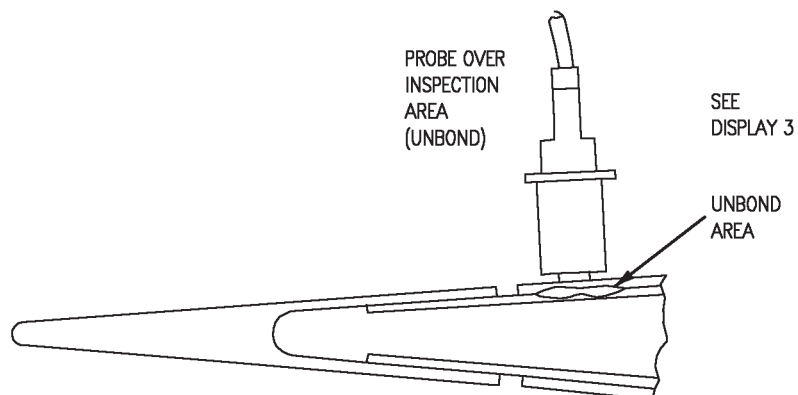


DISPLAY 1  
STANDARDIZATION  
RESPONSE



DISPLAY 2  
TYPICAL RESPONSE FROM  
GOOD BOND AREA

Figure 14. Good Bond/Unbond Responses (Sheet 1)



DISPLAY 3

TYPICAL RESPONSE  
FROM TITANIUM  
CLOSURE UNBOND

Figure 14. Good Bond/Unbond Responses (Sheet 2)

## INTERMEDIATE MAINTENANCE

## NONDESTRUCTIVE INSPECTION

## HORIZONTAL STABILATOR

## OUTBOARD AFT CORE SPLICE AREA

## PART NO. 74R092026

### Reference Material

Plane Captain Manual .....	A1-F18AC-PCM-000
Naval Aviation Maintenance Program .....	OPNAVINST 4790.2
Nondestructive Inspection.....	A1-F18AC-SRM-300
Ultrasonic Through Transmission Contact Testing, Standardization, and Inspection Procedures For Composite Laminate Skin Bonded to Honeycomb Core.....	WP008 01
General Information .....	WP003 00
Radiographic Method.....	WP005 00
Ultrasonic Through Transmission Contact Testing, Standardization, and Inspection Procedures For Composite Laminate and Metallic Skins Bonded to Honeycomb Core .....	WP008 10
Nondestructive Inspection Methods .....	NAVAIR 01-1A-16

### Alphabetical Index

Subject	Page No.
Horizontal Stabilator.....	2
Defects .....	2
Post Inspection Cleaning and Corrosion Control.....	7
Primary Inspection Methods.....	2
Radiographic Method .....	2
Ultrasonic Method Using C-398 Ultrasonic Flaw Detector .....	4
Ultrasonic Method Using MXU-715/E Ultrasonic Flaw Detector .....	5

### Record of Applicable Technical Directives

Type/ Number	Date	Title and ECP No.	Date Incorp.	Remarks
F/A-18 AFC 25	6 Apr 83	Integrated Flight Controls, Horizontal Stabilizers, Modification of (ECP MDA-F/A-18-00127)	1 Oct 83	-

1. **HORIZONTAL STABILATOR.**

2. Horizontal stabilator is bonded honeycomb assembly. Honeycomb core is 0.125, 0.156, 0.188, and 0.250 inch hexagonal cell aluminum alloy. Skin is graphite epoxy with titanium splice plate in spindle area. Structure enclosing core is titanium spars, ribs, and graphite epoxy rib. Surface finish is epoxy primer and polyurethane coatings.

3. **DEFECTS.** Inspect for skin to core unbonds and honeycomb core defects. Examples of some defects that may develop in bonded assembly are contained in (WP003 00).

4. **PRIMARY INSPECTION METHODS.** There are two primary inspection methods, radiographic and ultrasonic.

5. **Personnel Qualifications.** Personnel doing this nondestructive inspection should be qualified and certified to do radiographic and ultrasonic inspections per OPNAVINST 4790.2 SERIES, NDI Technicians, NEC 7225/MOS 6044..

6. **Preparation of Aircraft.** No special preparation required.

7. **Access.** No special access required.

8. **RADIOGRAPHIC METHOD.** See figure 1.

**Support Equipment Required**

Part Number or Type Designation	Nomenclature
MIL-STD-453 GXR7-6B	Penetrameter Set X-ray Apparatus, Portable
072-000 314X —	X-ray Film Processor Film Identification Set Lead Tab Locators

**Materials Required****NOTE**

Alternate item specifications or part numbers are shown indented.

Specification or Part Number	Nomenclature
INDUSTREX M FILMCODE M2	Radiographic Film, X-ray Film 14 x 17
INDUSTREXAA FILMCODEAA2 14x17	Radiographic Film, X-ray Film, 14x17
MIL-P-83953-2, TYPE 1, CLASS A or B, RED or BLACK A-A-883, TYPE 1	Aircraft Marking Pencil  Pressure Sensitive Tape, Masking Tape

9. **Preparation of Part.** No special preparation required.

**WARNING**

HIGH RADIATION.

Make sure applicable safety precautions (WP005 00) and NAVAIR 01-1A-16 are complied with. Failure to comply may result in injury to personnel.

10. **Equipment Settings/Standardization/Setup.**

a. Set X-ray unit per data contained in technique chart, see figure 1.

b. Locate inspection area, aiming points, and film locations for outboard aft core splice area, see figure 1.

(1) Construct line A-B on upper and lower surface of part.

(2) Locate and mark point A. Point A is 22 inches aft of outboard leading edge corner along line which is perpendicular to leading edge skin to closure line. Line starts at outboard leading edge skin to closure corner.

(3) Locate and mark point B. Point B is 25 inches aft of outboard leading edge corner along line which is coincident to outboard skin to closure line. Line starts at outboard leading edge skin to closure corner.

(4) With points A and B located and marked on both surfaces of part, use straight edge to draw line between two points. Line length inboard from point B should be approximately 26 to 30 inches.

(5) Using point A, locate and mark aiming points for shots 1 through 3 on lower surface of part.

(6) Using line A-B, locate and mark film locations on upper surface of part.

c. Attach lead tab locators and film identification markers to upper surface of part.

d. Attach penetrometer to lower surface of part.

### 11. Inspection Procedure.

#### NOTE

X-ray film for shots are double loaded. M film is located next to part and both films are exposed simultaneously.

a. Locate and tape film for shot 1 on upper surface of part. Make sure M film is located nearest X-ray source, next to part surface, and part and shot identifications are located between part surface and film.

b. Locate source to aiming point for shot 1. Source should be normal to aiming point, see figure 2.

#### NOTE

Alternate setup which locates X-ray source at least 50 inches above upper surface is allowed. If alternate is used, reverse upper and lower surface locations of lead tab locators, identification markers, penetrameters, aiming points, and film. Make sure film is in contact with lower surface of part and M film is next to skin.

c. On all shots, make sure X-ray source window is parallel to upper surface of part or surface where

film will be located. Radiation cone central beam must be perpendicular to plane of film and pass through correct aiming point. Plumb bob type device is recommended for establishing correct central beam and film plane alignment. If required, reorient part surface.

d. Expose film for shot 1 per technique chart, see figure 1.

e. Remove film, of shot 1 exposure, from part surface.

f. Repeat steps a. through e. for films 2 and 3 and shots 2 and 3.

### 12. Film Development and Interpretation.

a. Develop exposed films of shot's 1 through 3.

#### NOTE

Fatigue or torn core is most reliably detected when cell walls are laid over slightly. It is important to review film in areas where cell layover is observed. Interpret areas away from X-ray beam central ray.

b. Review exposed film for failed honeycomb core. Compare appearance of honeycomb core indications with fatigue core reference radiograph. Fatigued or torn core is usually visible with thin dark and light jogged line across hexagonal cell faces of honeycomb core. Wrinkled core usually produces light and dark alternating straight line indications and is allowable condition.

c. Mark all areas on X-ray film where there are hexagonal cells with failed hexagonal cell wall indications.

d. Use figure 3 to aid determining number of failed shear paths and perpendicular failed shear paths in each 4.00 square inch section of aft core splice area, area A, and total number of shear paths and perpendicular shear paths in ballast area, area B.

### 13. ULTRASONIC METHOD USING C-398 ULTRASONIC FLAW DETECTOR.

#### Support Equipment Required

##### NOTE

Alternate item type designations or part numbers are listed in parentheses.

Part Number or Type Designation	Nomenclature
C-398 (303B)	Ultrasonic Flaw Detector
57A2271 or EQUIVALENT	Microdot to BNC Connecting Cable, 2 Req'd.
57A2276 or EQUIVALENT	0°, 0.500 Dia., 2.25 MHz, Contact, Delay line, Search Unit, 2 Req'd.

#### Materials Required

##### NOTE

Alternate item specifications or part numbers are shown indented.

Specification or Part Number	Nomenclature
ULTRAGEL II OR EQUIVALENT	Couplant
MIL-P-83953-2, TYPE 1, CLASS A OR B, BLACK OR RED	Aircraft Marking Pencil
P-D-680, TYPE 2	Dry Cleaning Solvent
D 1153	Methyl Isobutyl Ketone
CCC-C-46, TYPE 1, CLASS 4	Cleaning Cloth

### 14. Preparation of Part.

#### WARNING

Dry cleaning solvent and methyl isobutyl ketone are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

a. Clean inspection area(s) with solvent moistened cloth to make sure inspection area(s) is free of contamination or foreign material.

b. Lay out 4X4 inch grid on upper and lower surfaces of part, see figure 3.

c. Use exposed and developed X-ray film to outline foam splice lines on upper surface of part. Make sure film identification markers on part surface coincide with lead tab locators imaged onto film.

#### WARNING

Make sure safety precautions have been met for electrical, static, grounding when using eddy current equipment near aircraft fuel cells, oxygen systems, electrical systems, and stores (A1-F18AC-PCM-000).

### 15. Equipment Setting/Standardization/Setup For Skin to Core Bondlines.

a. Do equipment settings/standardization/setup (WP008 01), except use 0°, 0.500 inch, 2.25 MHz search unit.

##### NOTE

Equipment differences may require use of alternate REP. RATE, DAMP., FREQ., GAIN, SWEEP DELAY, and SWEEP RANGE.

b. Apply couplant to upper and lower surfaces of point C setup point shown in figure 1.

c. Position search units on both surfaces of part at setup point.



**NOTE**

GAIN may be adjusted by changing FINE GAIN, COARSE GAIN, or by toggling ATTENUATORS.

d. Adjust GAIN, FINE SWEEP RANGE, FINE SWEEP DELAY, and REJECT so leading edge of received signal response is located at 4 on CRT horizontal baseline when peak amplitude is 80 to 90 percent CRT height, see figure 4, CRT 1. Minimum reject is recommended.

e. Make sure search unit alignment is correct.

**NOTE**

Initial search unit alignment may be established by maximizing signal response. Search unit alignment must be maintained during inspection. Alignment yoke may be manufactured as shown in (WP008 01).

f. Use previously taken radiographs to make sure search units are not positioned over core splice, multiple layers of adhesive, or core defects during setup.

g. After setup has been completed, move over foam splice and observe reduction in amplitude of received signal.

#### 16. Inspection Procedure For Skin to Core Bondlines.

a. Using above through transmission setup, scan skin to core inspection area shown in figure 1.

b. Make sure inspection area has been completely outlined.

c. Part thickness changes may require adjustment of COARSE SWEEP RANGE or FINE SWEEP RANGE to keep received response on the CRT.

d. Mark all areas where through transmission received signal response peak drops below 5 percent CRT height even after 12 dB of gain has been added. Example of flaw response is shown in figure 4, CRT 2.

e. Use radiographic method to determine if suspected flaw area is result of extra layers of film

adhesive, foaming adhesive, or core splice. Also, core defects such as crushed core or torn core will cause abnormal ultrasonic attenuation. Review films of suspected areas for these types of anomalies.

f. Do paragraph 21.

#### 17. ULTRASONIC METHOD USING MXU-715/E ULTRASONIC FLAW DETECTOR.

#### Support Equipment Required

Part Number or Type Designation	Nomenclature
1642AS100-1	Ultrasonic Flaw Detector, MXU-715/E, Magnaflux
57A2271 or EQUIVALENT	Microdot to BNC Connecting Cable, 2 Req'd.
57A2276 or EQUIVALENT	0°, 0.500 Dia., 2.25 MHz, Contact, Delay line, Search Unit, 2 Req'd.

#### Materials Required

**NOTE**

Alternate item specifications or part numbers are shown indented.

Specification or Part Number	Nomenclature
ULTRAGEL II OR EQUIVALENT	Couplant
MIL-P-83953-2, TYPE 1, CLASS A OR B, BLACK OR RED	Aircraft Marking Pencil
P-D-680, TYPE 2	Dry Cleaning Solvent
D 1153	Methyl Isobutyl Ketone
CCC-C-46, TYPE 1, CLASS 4	Cleaning Cloth

## 18. Preparation of Part.

**WARNING**

Dry cleaning solvent and methyl isobutyl ketone are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

- a. Clean inspection area(s) with solvent moistened cloth to make sure inspection area(s) is free of contamination or foreign material.
- b. Lay out 4X4 inch grid on upper and lower surfaces of part, see figure 3.
- c. Use exposed and developed X-ray film to outline foam splice lines on upper surface of part. Make sure film identification markers on part surface coincide with lead tab locators imaged onto film.

**WARNING**

Make sure safety precautions have been met for electrical, static, grounding when using eddy current equipment near aircraft fuel cells, oxygen systems, electrical systems, and stores (A1-F18AC-PCM-000).

## 19. Equipment Setting/Standardization/Setup For Skin to Core Bondlines.

- a. Do equipment settings/standardization/setup (WP008 10), except use 0°, 0.500 inch, 2.25 MHz search unit.

**NOTE**

Equipment differences may require use of alternate REP. RATE, DAMP., FREQ., GAIN, HORIZONTAL SWEEP DELAY, AND length.

- b. Apply couplant to upper and lower surfaces of point C setup point shown in figure 1.
- c. Position search units on both surfaces of part at setup point.

- d. Adjust GAIN, HORIZONTAL SWEEP LENGTH, AND delay, damp., and REJECT so leading edge of received signal response is located at 4 on CRT horizontal baseline when peak amplitude is 80 to 90 percent CRT height, see figure 4, CRT 1. Minimum reject is recommended.

- e. Make sure search unit alignment is correct.

**NOTE**

Initial search unit alignment may be established by maximizing signal response. Search unit alignment must be maintained during inspection. Alignment yoke may be manufactured as shown in (WP008 10).

- f. Use previously taken radiographs to make sure search units are not positioned over core splice, multiple layers of adhesive, or core defects during setup.

- g. After setup has been completed, move over foam splice and observe reduction in amplitude of received signal.

## 20. Inspection Procedure For Skin to Core Bondlines.

- a. Using above through transmission setup, scan skin to core inspection area shown in figure 1.

- b. Make sure inspection area has been completely outlined.

- c. Part thickness changes may require adjustment of HORIZONTAL SWEEP COURSE or FINE LENGTH to keep received response on CRT.

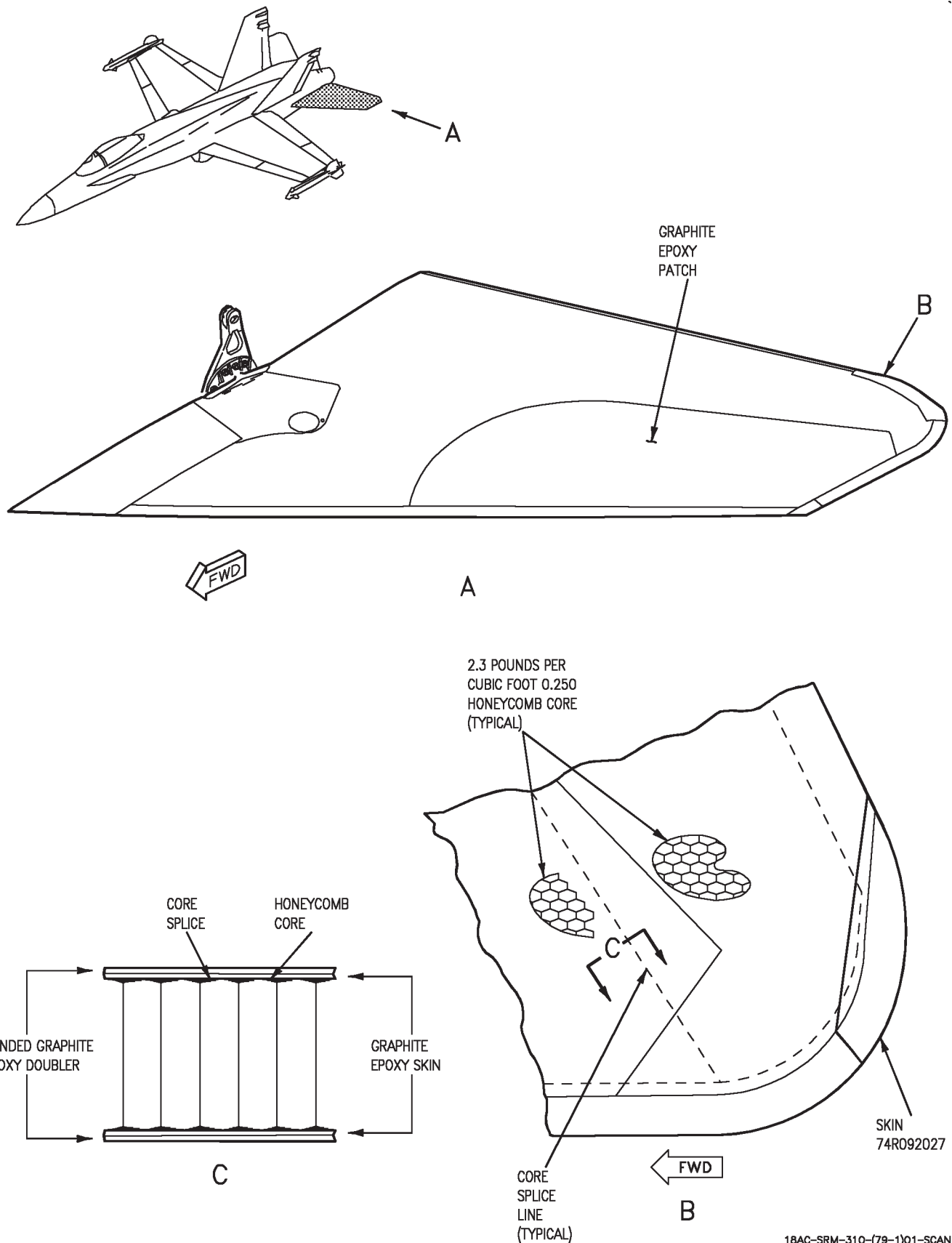
- d. Mark all areas where through transmission received signal response peak drops below 5 percent CRT height even after 12 dB of gain has been added. Example of flaw response is shown in figure 4, CRT 2.

- e. Use radiographic method to determine if suspected flaw area is result of extra layers of film adhesive, foaming adhesive, or core splice. Also, core defects such as crushed core or torn core will cause abnormal ultrasonic attenuation. Review films of suspected areas for these types of anomalies.

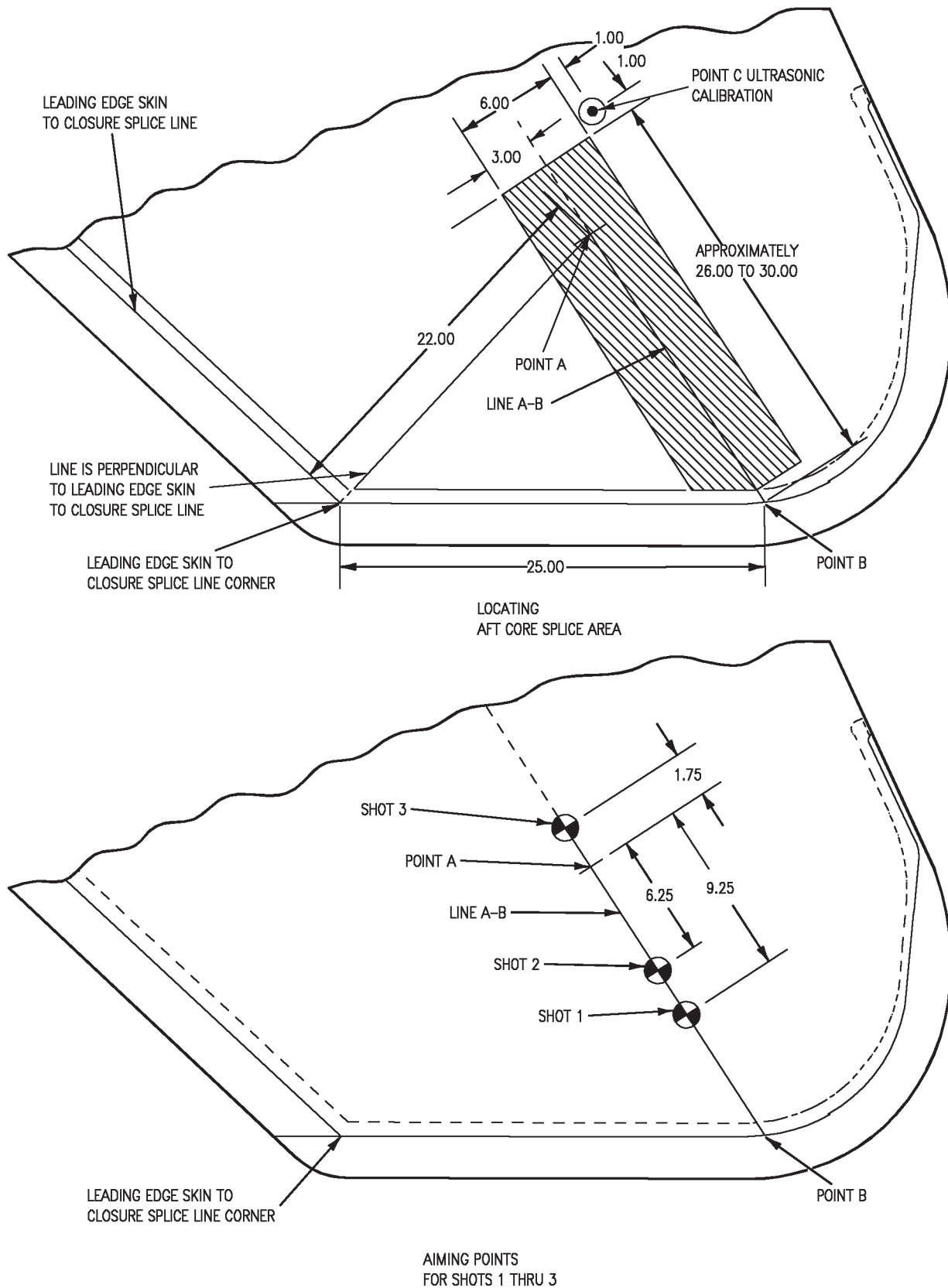
## WARNING

Dry cleaning solvent and methyl isobutyl ketone are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

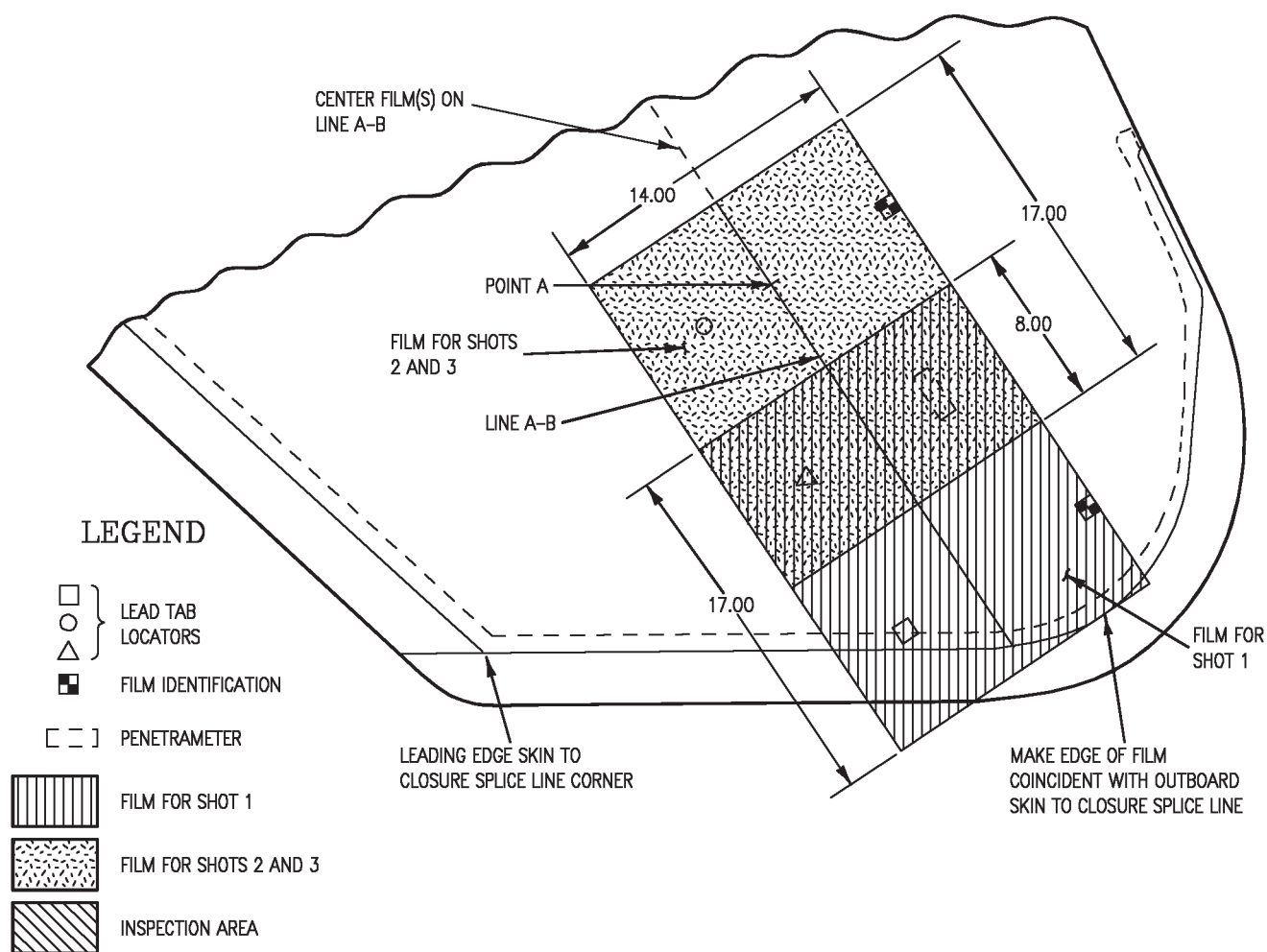
**21. POST INSPECTION CLEANING AND CORROSION CONTROL.** Clean inspection area(s) with solvent moistened cloth to make sure inspection area(s) is free of contamination or foreign material.



**Figure 1. Outboard Aft Core Splice Area Inspection (Sheet 1)**



**Figure 1. Outboard Aft Core Splice Area Inspection (Sheet 2)**



TECHNIQUE CHART								
SHOT	FILM SIZE	FILM GROUP	SCREEN	PENETRATOR MIL-STD-453	mA	kVP	EXPOSURE (MINUTES) 1	DENSITY 2
1	14X17	AA AND M	NO	0.25AL	5	40	1	1.0-3.0
2	14X17	AA AND M	NO	0.25AL	5	40	1	1.0-3.0
3	14X17	AA AND M	NO	0.25AL	5	40	1	1.0-3.0
LEGEND								
1 INCREASE OR DECREASE EXPOSURE TIME AS REQUIRED TO GET A PREFERRED FILM DENSITY OF 2.0.								
2 FILM DENSITY OF 2.0 IS PREFERRED.								

Figure 1. Outboard Aft Core Splice Area Inspection (Sheet 3)

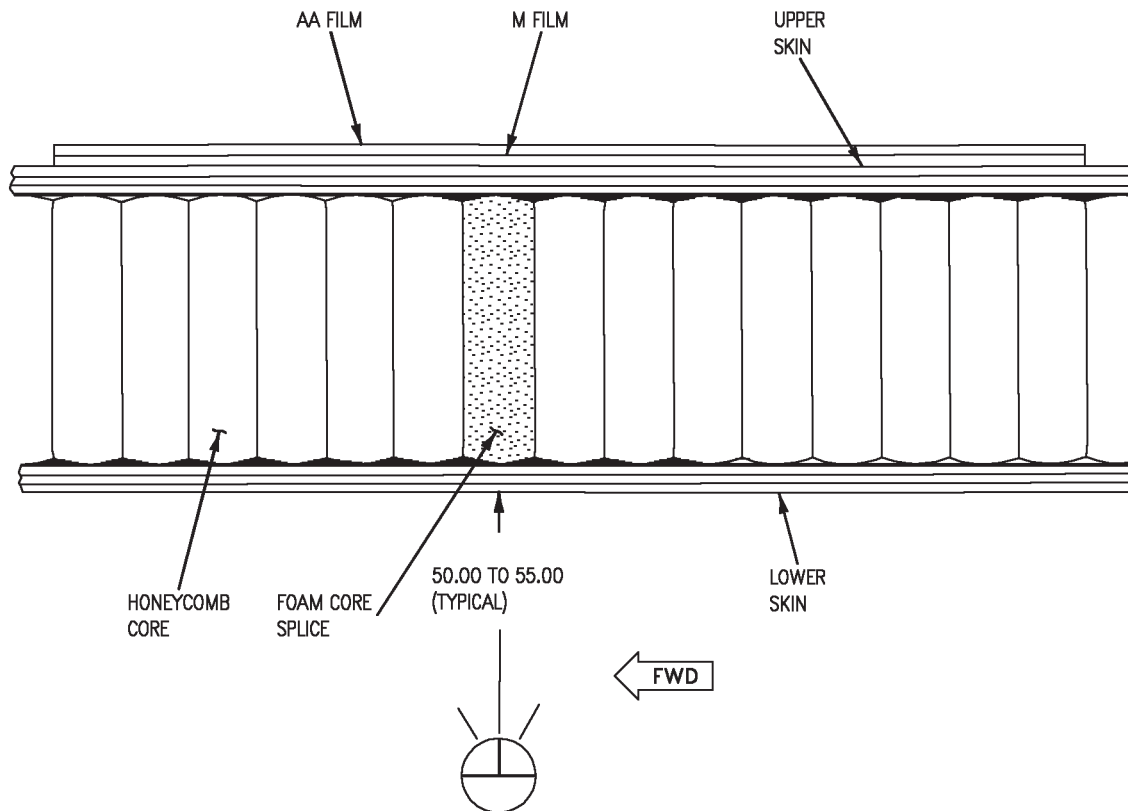


Figure 2. Typical X-Ray Inspection Setup

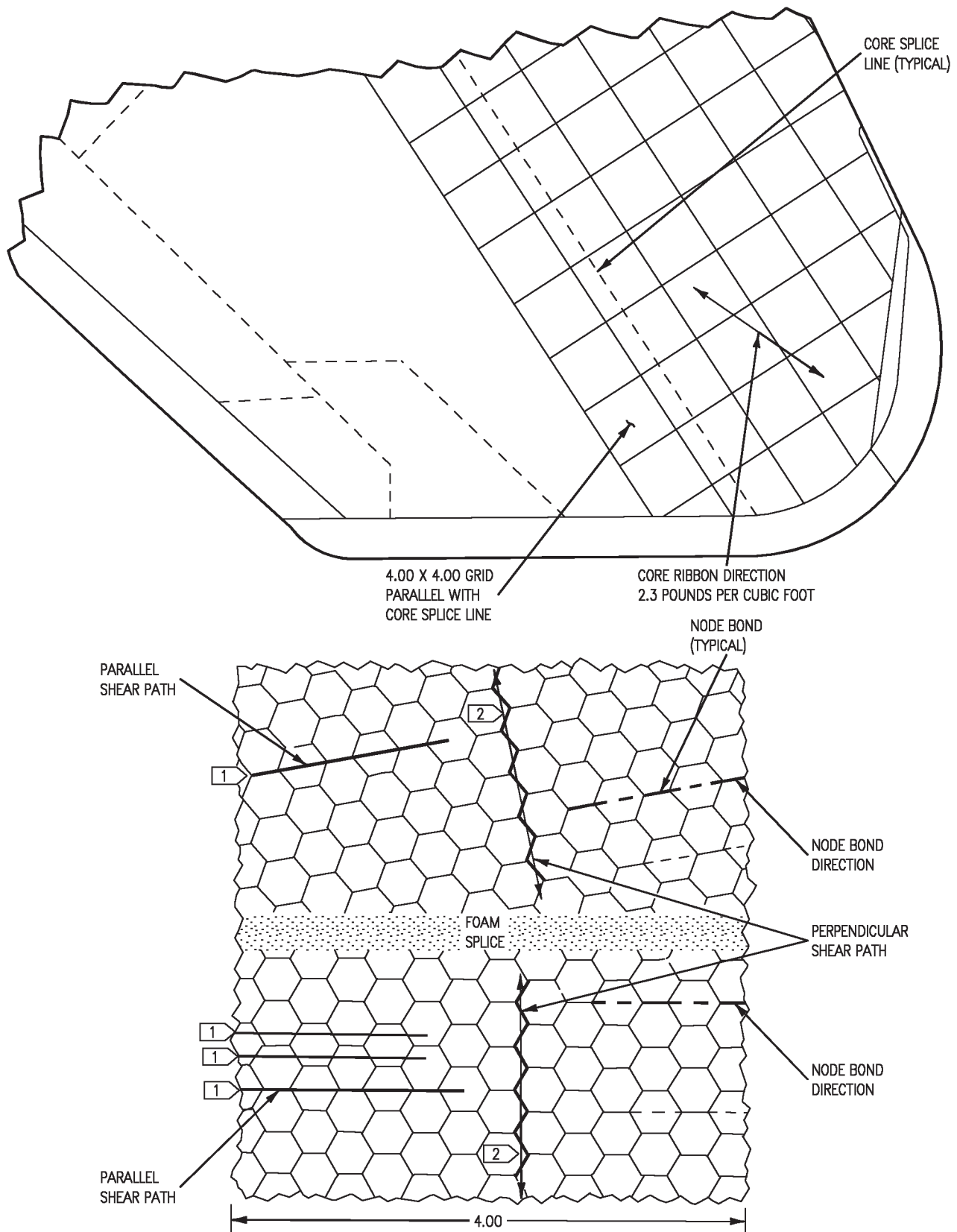


Figure 3. Definition and Examples of Shear Path Failure (Sheet 1)



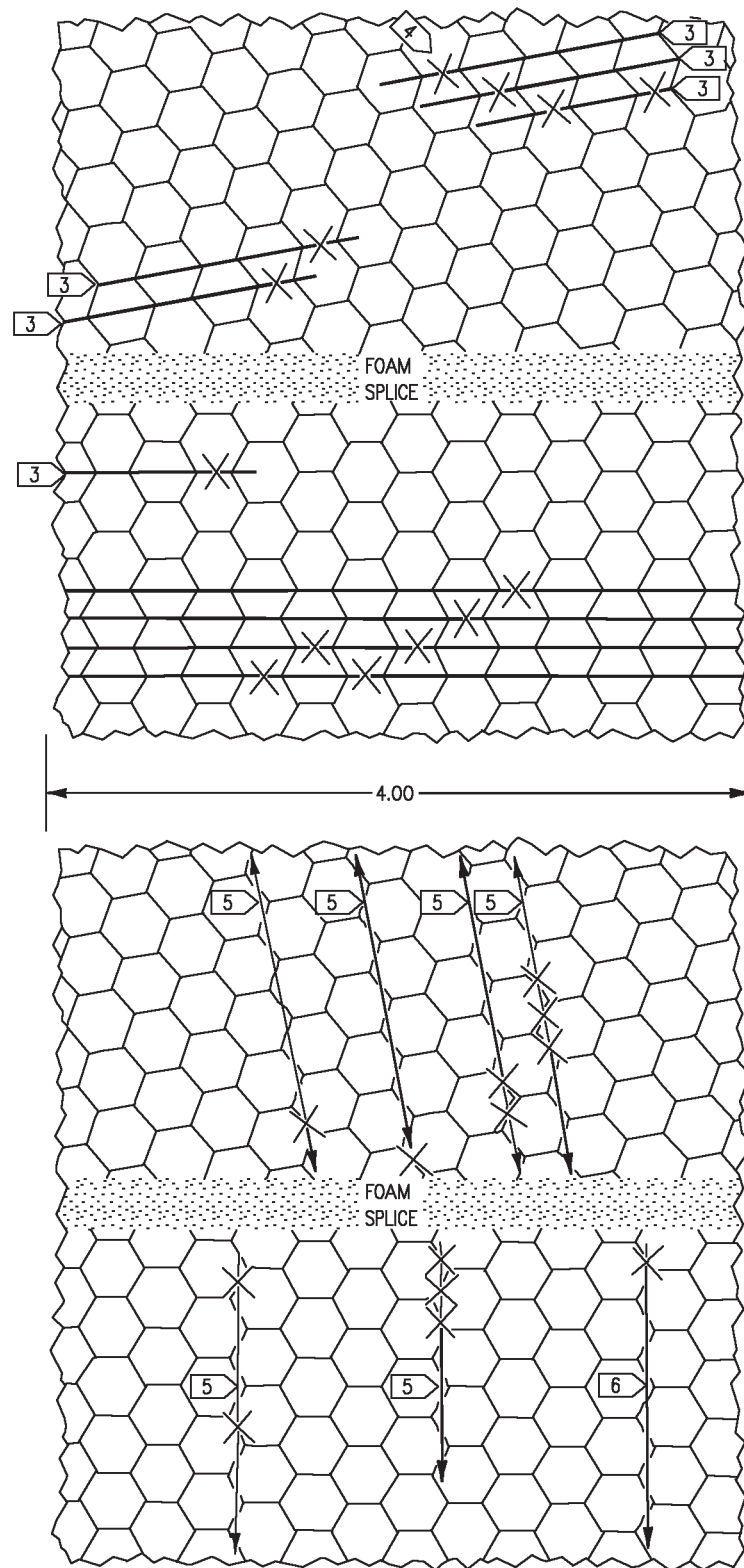
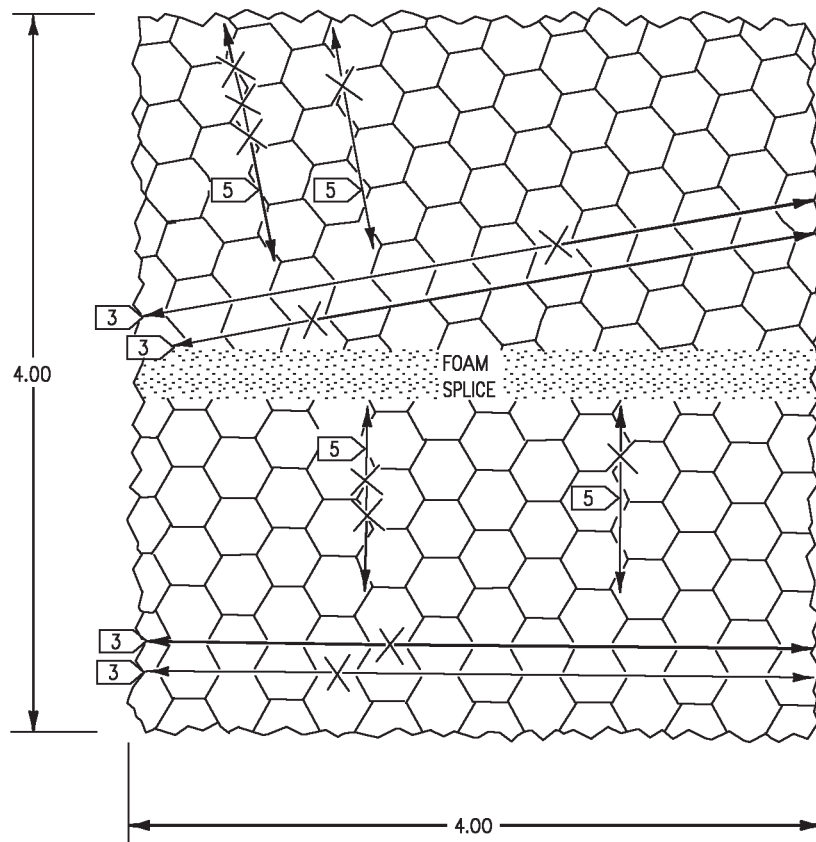


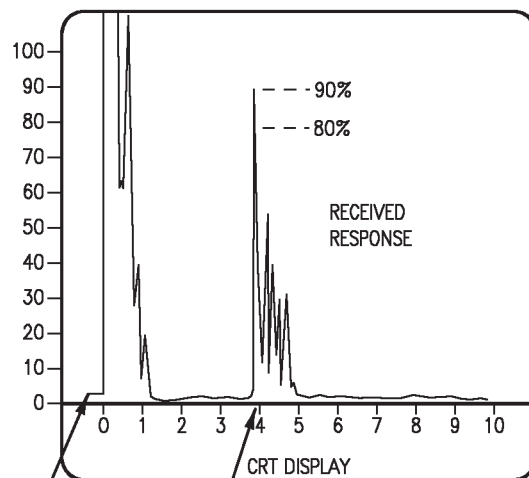
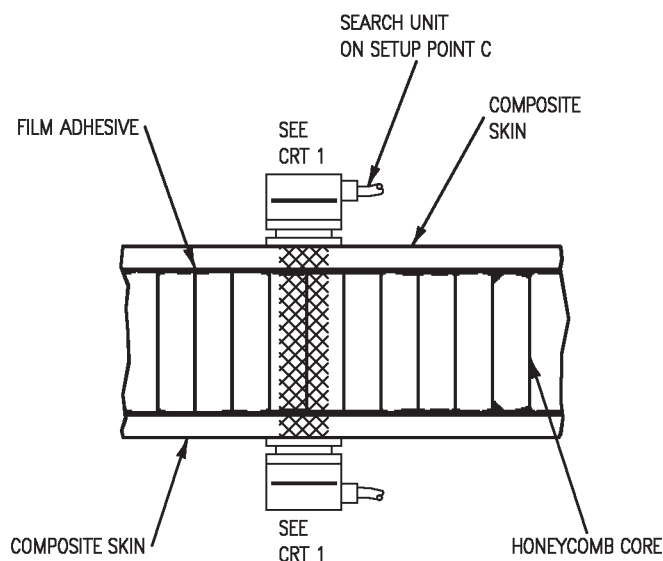
Figure 3. Definition and Examples of Shear Path Failure (Sheet 2)



### LEGEND

- 1 > PARALLEL SHEAR PATH IS ANY LINE PARALLEL TO OR COINCIDENT WITH NODE BOND DIRECTION.
- 2 > PERPENDICULAR SHEAR PATH DIRECTION IS PERPENDICULAR TO NODE BOND DIRECTION.
- 3 > PARALLEL SHEAR PATH FAILURE.
- 4 > X = CELL WALL TEAR OR CRACK (TYPICAL).
- 5 > PERPENDICULAR SHEAR PATH FAILURE.
- 6 > NOT A PERPENDICULAR SHEAR PATH FAILURE.

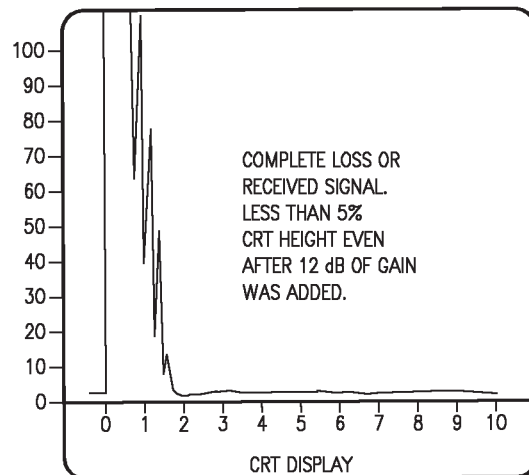
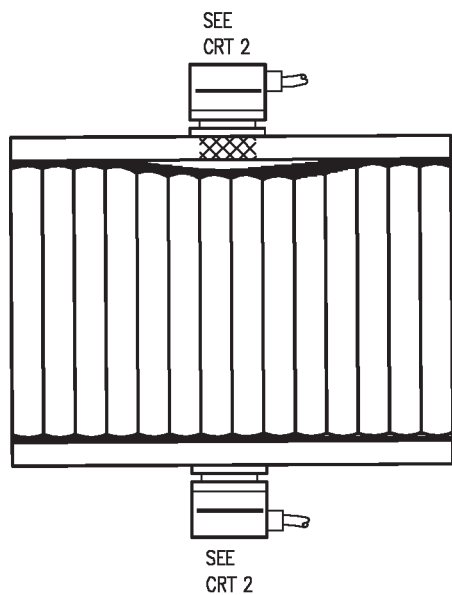
Figure 3. Definition and Examples of Shear Path Failure (Sheet 3)



LEADING EDGE  
OF INITIAL PULSE  
LOCATED AT ZERO

LEADING EDGE OF RECEIVED  
RESPONSE LOCATED AT 4 ON  
THE HORIZONTAL BASELINE.

LOCATION OF RECEIVED RESPONSE  
WILL MOVE ALONG HORIZONTAL BASELINE AS  
ASSEMBLY THICKNESS INCREASES  
OR DECREASES



CRT 2

Figure 4. Ultrasonic Through Transmission Setup and Inspection



## INTERMEDIATE MAINTENANCE

## NONDESTRUCTIVE INSPECTION

## HORIZONTAL STABILATOR

## OUTBOARD AFT CORE SPLICE AND BALLAST AREA

## PART NO. 74A210004-1007 OR 74G210004-1003

## Reference Material

Plane Captain Manual .....	A1-F18AC-PCM-000
Nondestructive Inspection.....	A1-F18AC-SRM-300
Ultrasonic Through Transmission Contact Testing, Standardization, and Inspection Procedures For Composite Laminate and Metallic Skins Bonded to Honeycomb Core .....	WP008 10
Ultrasonic Through Transmission Contact Testing, Standardization, and Inspection Procedures For Composite Laminate Skin Bonded to Honeycomb Core.....	WP008 01
General Information .....	WP003 00
Radiographic Method.....	WP005 00
Nondestructive Inspection Methods.....	NAVAIR 01-1A-16
Naval Aviation Maintenance Program .....	OPNAVINST 4790.2

## Alphabetical Index

Subject	Page No.
Horizontal Stabilator.....	1
Defects .....	1
Post Inspection Cleaning and Corrosion Control.....	7
Primary Inspection Methods.....	2
Radiographic Method .....	2
Ultrasonic Method Using C-398 Ultrasonic Flaw Detector .....	4
Ultrasonic Method Using MXU-715/E Ultrasonic Flaw Detector .....	6

## Record of Applicable Technical Directives

None

## 1. HORIZONTAL STABILATOR.

2. Horizontal stabilator is bonded honeycomb assembly. Honeycomb core is 0.125, 0.156, 0.188, and 0.250 inch hexagonal cell aluminum alloy. Skin is graphite epoxy with titanium splice plate in spindle area. Structure enclosing core is titanium

spars, ribs, and graphite epoxy rib. Surface finish is epoxy primer and polyurethane coatings.

3. **DEFECTS.** Inspect for skin to core unbonds and honeycomb core defects. Examples of some defects that may develop in bonded assembly are contained in (WP003 00).

4. **PRIMARY INSPECTION METHODS.** There are two primary inspection methods, radiographic and ultrasonic.

5. **Personnel Qualifications.** Personnel doing this nondestructive inspection should be qualified and certified to do radiographic and ultrasonic inspections per OPNAVINST 4790.2 SERIES, NDI Technicians, NEC 7225/MOS 6044.

6. **Preparation of Aircraft.** No special preparation required.

7. **Access.** No special access required.

8. **RADIOGRAPHIC METHOD.** See figure 1.

### Support Equipment Required

Part Number or Type Designation	Nomenclature
MIL-STD-453 GXR7-6B	Penetrameter Set X-ray Apparatus, Portable
072000 314X	X-ray Film Processor Film Identification Set
-	Lead Tab Locators

### Materials Required

#### NOTE

Alternate item specifications or part numbers are shown indented.

Specification or Part Number	Nomenclature
INDUSTREX M FILM CODE M2	Radiographic Film, X-ray Film, 14 x 17
MIL-P-83953-2, TYPE 1, CLASS A or B, RED or BLACK	Aircraft Marking Pencil
A-A-883, TYPE 1	Pressure Sensitive Tape, Masking Tape

9. **Preparation of Part.** No special preparation required.

### WARNING

#### HIGH RADIATION.

Make sure applicable safety precautions (WP005 00) and NAVAIR 01-1A-16 are complied with. Failure to comply may result in injury to personnel.

#### 10. Equipment Settings/Standardization/Setup.

a. Set X-ray unit per data contained in technique chart, see figure 1.

b. Locate inspection area, aiming points, and film locations for outboard aft core splice area, see figure 1.

(1) Construct line A-B on upper and lower surface of part.

(2) Locate and mark point A. Point A is 22 inches aft of outboard leading edge corner along line perpendicular to leading edge skin to closure line. Line starts at outboard leading edge skin to closure corner.

(3) Locate and mark point B. Point B is 25 inches aft of outboard leading edge corner along line coincident to outboard skin to closure line. Line starts at outboard leading edge skin to closure corner.

(4) With points A and B located and marked on both surfaces of part, use straight edge to draw line between the two points. Line length inboard from point B should be approximately 26 to 30 inches.

(5) Using point A, locate and mark aiming points for shots 1 through 3 on lower surface of part.

(6) Using line A-B, locate and mark film locations on upper surface of part.

c. Attach lead tab locators and film identification markers to upper surface of part.

d. Attach penetrameter to lower surface of part.

e. Locate aiming points and film locations for shots 4 through 7 on leading edge ballast area. See figure 1.

- (1) Locate and mark inspection area on part.
- (2) Locate and mark aiming points for shots 4 through 7 on lower surface of part.
- (3) Locate and mark film locations on upper surface of part.
- f. Attach lead tab locators and film identification markers to upper surface of part.

g. Attach penetrameters to lower surface of part.

## 11. Inspection Procedure.

### NOTE

X-ray film for shots are double loaded. M film is located next to part and both films are exposed simultaneously.

- a. Locate and tape film for shot 1 on upper surface of part. Make sure M film is located nearest X-ray source, next to part surface, and part and shot identifications are located between part surface and film.
- b. Locate source to aiming point for shot 1. Source should be normal to aiming point, see figure 2.

### NOTE

Alternate setup which locates X-ray source at least 50 inches above upper surface is allowed. If this alternate is used, reverse upper and lower surface locations of lead tab locators, identification markers, penetrameters, aiming points, and film. Make sure film is in contact with lower surface of part and M film is next to skin.

c. On all shots, make sure X-ray source window is parallel to upper surface of part or surface where film will be located. Radiation cone central beam must be perpendicular to plane of film and pass through correct aiming point. Plumb bob type device is recommended for establishing correct central beam and film plane alignment. If required, reorient part surface.

d. Expose film for shot 1 per technique chart, see figure 1.

e. Remove film, of shot 1 exposure, from part surface.

f. Repeat steps a through e for films 2 and 3 and shots 2 and 3.

g. Locate and tape film for shot 4 on upper surface of part. Make sure M film is located nearest X-ray source, next to part surface, and part and shot identification are located between part surface and film.

h. Locate source to aiming point for shot 4. Source should be normal to aiming point, see figure 2. Make sure central beam of radiation cone is perpendicular to film plane.

### NOTE

Alternate setup which locates X-ray source at least 50 inches above upper surface is allowed. If this alternate is used, reverse upper and lower surface locations of lead tab locators, identification markers, penetrameters, aiming points and film. Make sure film is in contact with lower surface of part and M film is next to skin.

i. Expose film for shot 4 per technique chart, see figure 1.

j. Remove film, of shot 4 exposure, from part surface.

k. Repeat steps g through j, for films 5 thru 7 and shots 5 through 7.

## 12. Film Development and Interpretation.

- a. Develop exposed films of shots 1 through 7.

### NOTE

Fatigued or torn core is most reliably detected when cell walls are laid over slightly. It is important to review film in areas where cell layover is observed. Interpret areas away from X-ray beam central ray.

b. Review exposed film for failed honeycomb core. Compare appearance of honeycomb core indications with fatigue core reference radiograph. Fatigued or torn core is usually visible with thin

dark and light jagged line across hexagonal cell faces of honeycomb core. Wrinkled core usually produces light and dark alternating straight line indications and is allowable condition.

c. Mark all areas on X-ray film where there are hexagonal cells with failed hexagonal cell wall indications.

d. Use figure 3 to aid determining number of failed shear paths and perpendicular failed shear paths in each 4.00 square inch section of aft core splice area, area A. Use figure 3 to aid determining total number of shear paths and perpendicular shear paths in ballast area, area B.

### 13. ULTRASONIC METHOD USING C-398 ULTRASONIC FLAW DETECTOR.

#### Support Equipment Required

##### NOTE

Alternate item type designations or part numbers are listed in parentheses.

Part Number or Type Designation	Nomenclature
C-398 (303B)	Ultrasonic Flaw Detector
57A2271 or EQUIVALENT	Microdot to BNC Connecting Cable, 2 Req'd.
57A2276 or EQUIVALENT	0°, 0.500 Dia., 2.25 MHz, Contact Delay Line, Search Unit, 2 Req'd.

#### Materials Required

##### NOTE

Alternate item specifications or part numbers are shown indented.

Specification or Part Number	Nomenclature
ULTRAGEL II	Couplant
MIL-P-83953-2, TYPE 1, CLASS A or B	Aircraft Marking Pencil
RED or BLACK	

#### Materials Required (Continued)

##### NOTE

Alternate item specifications or part numbers are shown indented.

Specification or Part Number	Nomenclature
P-D-680, TYPE 2 D 1153	Dry Cleaning Solvent Methyl Isobutyl Ketone
CCC-C-46, TYPE 1, CLASS 4	Cleaning Cloth

#### 14. Preparation of Part.

##### WARNING

Dry cleaning solvent and methyl isobutyl ketone is flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

a. Clean inspection area(s) with solvent moistened cloth to make sure inspection area(s) is free of contamination of foreign material.

b. Lay out 4 X 4 inch grid on upper and lower surfaces of part, see figure 3.

c. Use exposed and developed X-ray film to outline foam splice lines on upper surface of part. Make sure film identification markers on part surface coincide with lead tab locators imaged onto film.



## 15. Equipment Settings/Standardization/Setup For Skin to Core Bondlines.

### WARNING

Make sure safety precautions have been met for electrical, static, grounding when using eddy current equipment near aircraft fuel cells, oxygen systems, electrical systems, and stores (A1-F18AC-PCM-000).

- a. Do general setup, including initial equipment settings (WP008 01) except use 0°, 0.500 inch diameter, 2.25 MHz search unit.

### NOTE

Equipment differences may require use of alternate REP. RATE, DAMP., FREQ., GAIN, SWEEP DELAY and SWEEP RANGE.

- b. Apply couplant to upper and lower surfaces of point C setup point shown in figure 1.
- c. Position search units on both surfaces of part at setup point.

### NOTE

GAIN may be adjusted by changing FINE GAIN, COARSE GAIN, or by toggling ATTENUATORS.

- d. Adjust GAIN, FINE SWEEP DELAY, FINE SWEEP RANGE, DAMP., and REJECT so leading edge of received response is located at 4 on horizontal baseline when peak amplitude is 80 to 90 percent CRT height. See figure 4, CRT 1. Minimum reject is recommended.

- e. Make sure search unit alignment is correct.

### NOTE

Initial search unit alignment may be established by maximizing signal response. Search unit alignment must be maintained during inspection. Alignment yoke may be manufactured as shown in (WP008 01).

- f. Use previously taken radiographs to make sure search units are not positioned over core splice, multiple layers of adhesive, or core defects during setup.

- g. After setup has been completed, move over foam splice and observe reduction in amplitude of received signal.

## 16. Inspection Procedure For Skin to Core Bondlines.

- a. Using above through transmission setup, scan skin to core inspection area shown in figure 1.

- b. Make sure inspection area has been completely outlined.

- c. Part thickness changes may require adjustment of FINE SWEEP RANGE or COARSE SWEEP RANGE to keep received response on the CRT.

- d. Mark all areas where through transmission received signal response peak drops below 5 percent CRT height even after 12dB gain has been added. Flaw response will be similar to figure 4, CRT 2.

- e. Use radiographic method to determine if suspected flaw area is result of extra layers of film adhesive, foaming adhesive, or core splice. Also, core defects such as crushed core or torn core will cause abnormal ultrasonic attenuation. Review films of suspected areas for these types of anomalies.

- f. Do paragraph 22.

17. Deleted.

18. ULTRASONIC METHOD USING MXU-715/E  
ULTRASONIC FLAW DETECTOR.**Support Equipment Required**

Part Number or Type Designation	Nomenclature
1642AS100-1	Ultrasonic Flaw Detector, MXU- 715/E, Magnaflux
57A2271 or EQUIVALENT	Microdot to BNC Connecting Cable, 2 Req'd.
57A2276 or EQUIVALENT	0°, 0.500 Dia., 2.25 MHz, Contact Delay Line, Search Unit, 2 Req'd.

**Materials Required****NOTE**

Alternate item specifications or part numbers are shown indented.

Specification or Part Number	Nomenclature
ULTRAGEL II	Couplant
MIL-P-83953-2, TYPE 1, CLASS A or B RED or BLACK	Aircraft Marking Pencil
P-D-680, TYPE 2 D 1153	Dry Cleaning Solvent Methyl Isobutyl Ketone
CCC-C-46, TYPE 1, CLASS 4	Cleaning Cloth

## 19. Preparation of Part.

**WARNING**

Dry cleaning solvent and methyl isobutyl ketone is flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

a. Clean inspection area(s) with solvent moistened cloth to make sure inspection area(s) is free of contamination of foreign material.

b. Lay out 4 X 4 inch grid on upper and lower surfaces of part, see figure 3.

c. Use exposed and developed X-ray film to outline foam splice lines on upper surface of part. Make sure film identification markers on part surface coincide with lead tab locators imaged onto film.

20. Equipment Settings/Standardization/Setup  
For Skin to Core Bondlines.**WARNING**

Make sure safety precautions have been met for electrical, static, grounding when using eddy current equipment near aircraft fuel cells, oxygen systems, electrical systems, and stores (A1-F18AC-PCM-000).

a. Do general setup, including initial equipment settings (WP008 10) except use 0°, 0.500 inch diameter, 2.25 MHz search unit.

**NOTE**

Equipment differences may require use of alternate REP. RATE, DAMP., FREQ., GAIN, HORIZONTAL SWEEP, DELAY and LENGTH.

b. Apply couplant to upper and lower surfaces of point C setup point shown in figure 1.

c. Position search units on both surfaces of part at setup point.

d. Adjust GAIN, HORIZONTAL SWEEP DELAY, SWEEP LENGTH, DAMP., and REJECT so leading edge of received response is located at 4 on horizontal baseline when peak amplitude is 80 to 90 percent CRT height. See figure 4, CRT 1. Minimum reject is recommended.

e. Make sure search unit alignment is correct.

## NOTE

Initial search unit alignment may be established by maximizing signal response. Search unit alignment must be maintained during inspection. Alignment yoke may be manufactured as shown in (WP008 10).

f. Use previously taken radiographs to make sure search units are not positioned over core splice, multiple layers of adhesive, or core defects during setup.

g. After setup has been completed, move over foam splice and observe reduction in amplitude of received signal.

## 21. Inspection Procedure For Skin to Core Bondlines.

a. Using above through transmission setup, scan skin to core inspection area shown in figure 1.

b. Make sure inspection area has been completely outlined.

c. Part thickness changes may require adjustment of HORIZONTAL SWEEP COURSE or FINE LENGTH to keep received response on the CRT.

d. Mark all areas where through transmission received signal response peak drops below 5 percent CRT height even after 12dB gain has been added. Flaw response will be similar to figure 4, CRT 2.

e. Use radiographic method to determine if suspected flaw area is result of extra layers of film adhesive, foaming adhesive, or core splice. Also, core defects such as crushed core or torn core will cause abnormal ultrasonic attenuation. Review films of suspected areas for these types of anomalies.

## WARNING

Dry cleaning solvent and methyl isobutyl ketone are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

## 22. POST INSPECTION CLEANING AND CORROSION CONTROL.

Clean inspection area(s) with solvent moistened cloth to make sure inspection area(s) is free of contamination or foreign material.

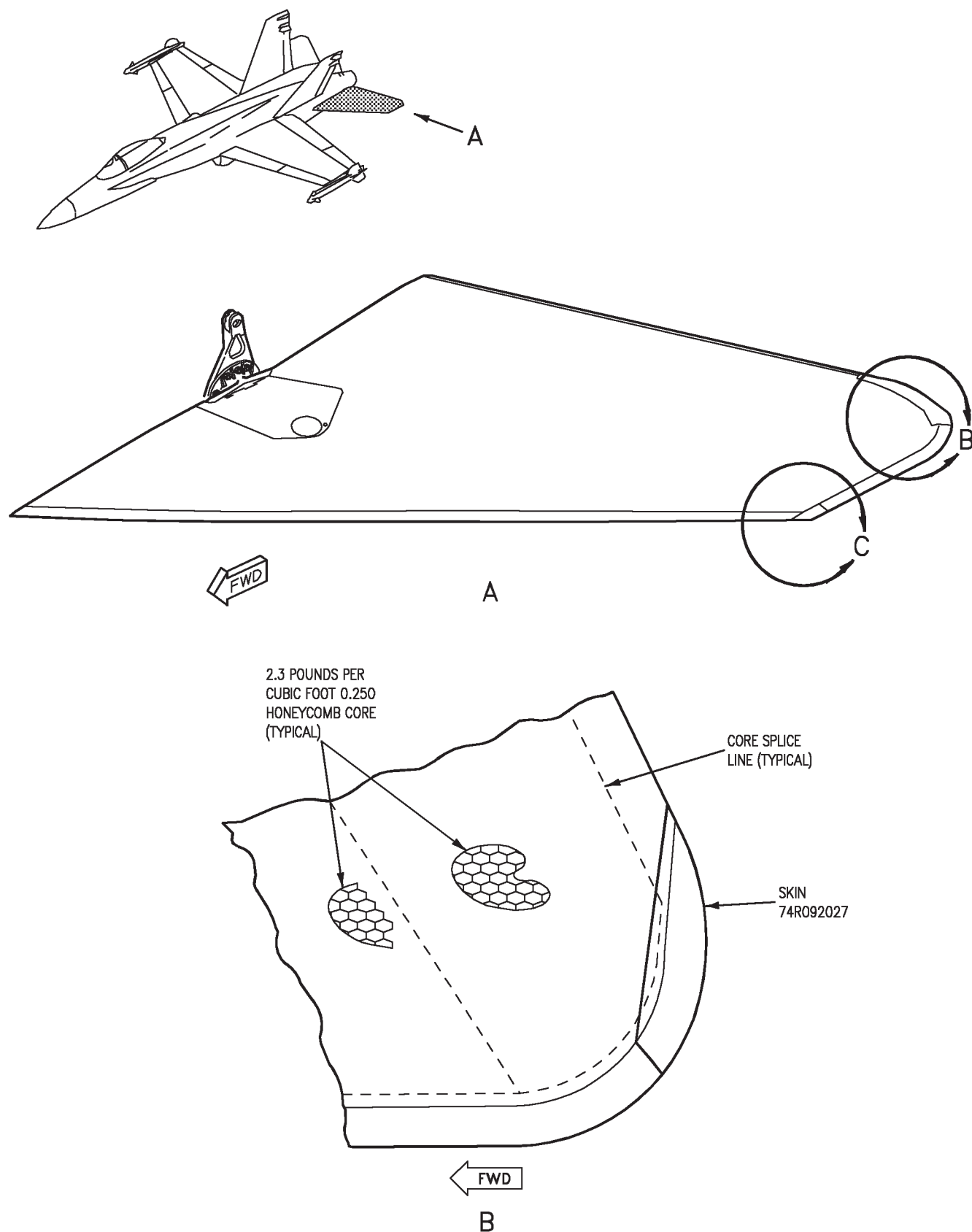
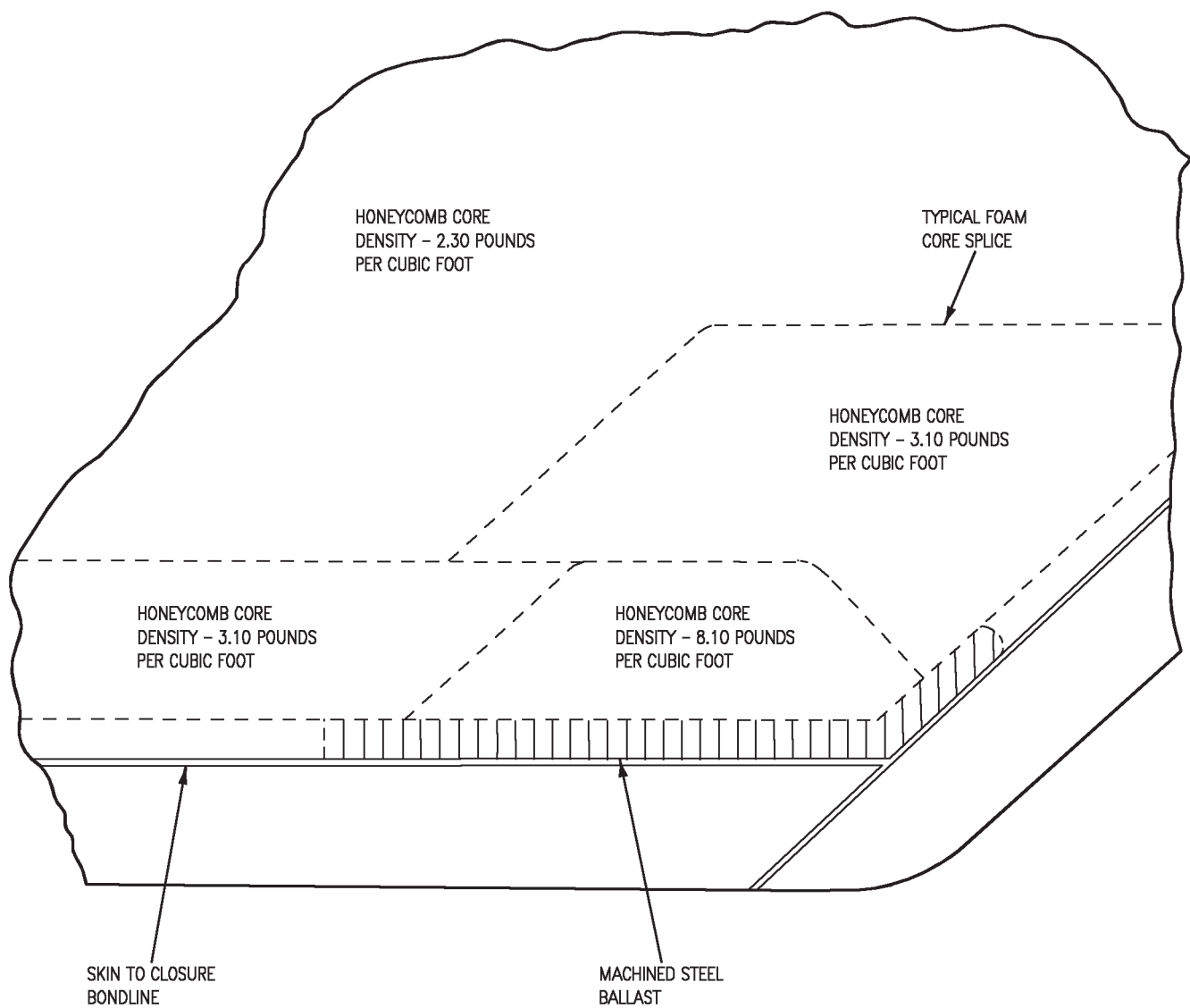


Figure 1. Outboard Aft Core Splice Area and Ballast Area Inspection (Sheet 1)



C

74A210004-1007 CONFIGURATION

**Figure 1. Outboard Aft Core Splice Area and Ballast Area Inspection (Sheet 2)**

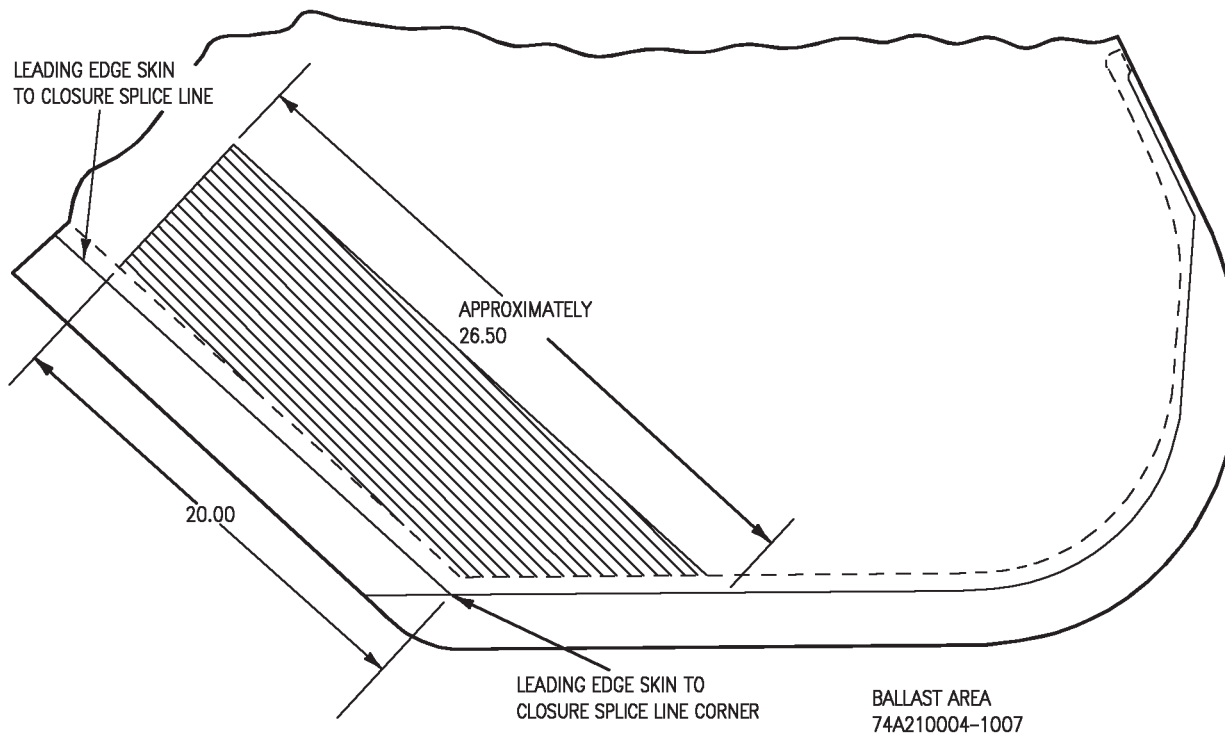
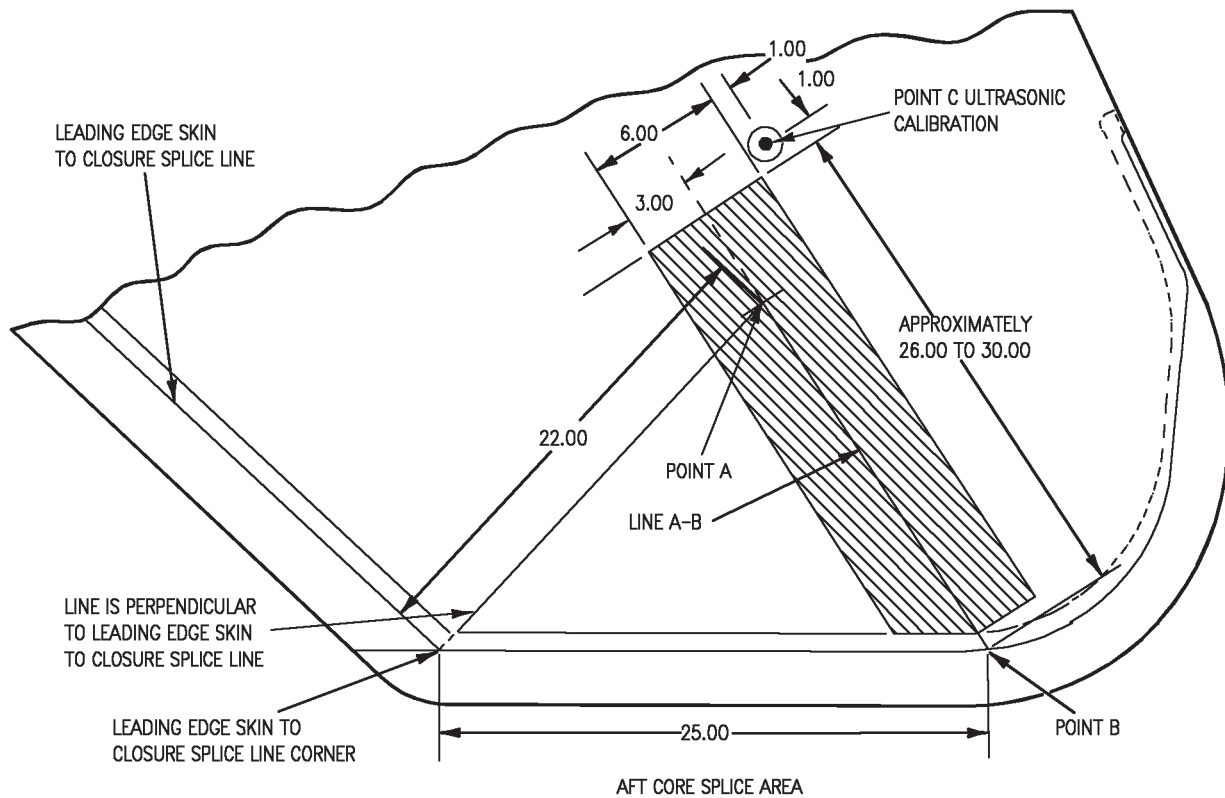
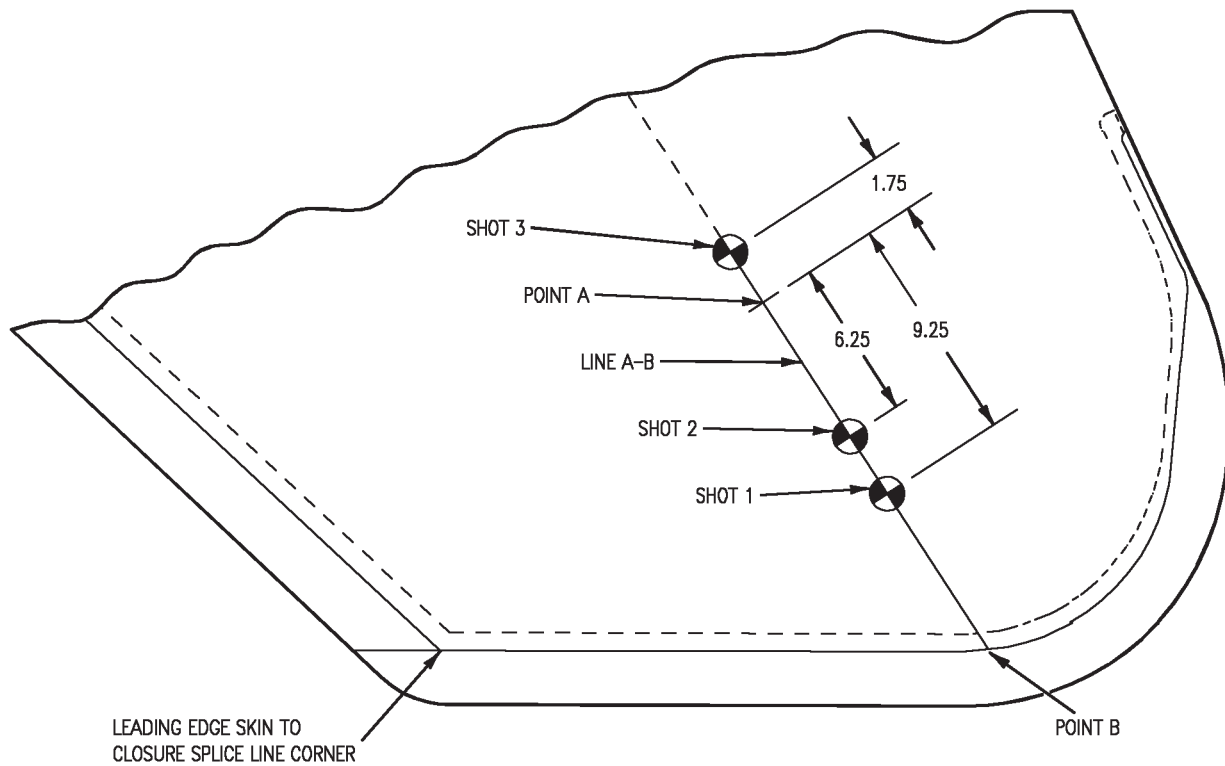
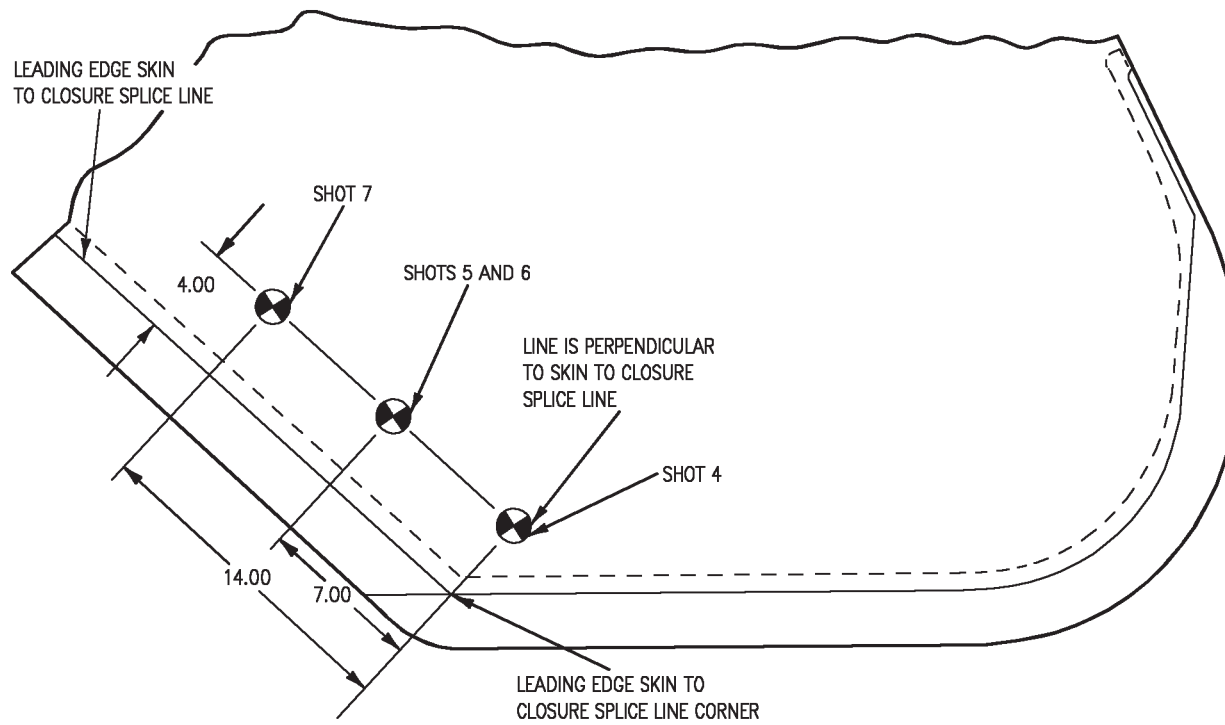


Figure 1. Outboard Aft Core Splice Area and Ballast Area Inspection (Sheet 3)



AIMING POINTS  
FOR SHOTS 1 THRU 3



AIMING POINTS FOR  
SHOTS 4 THRU 7

**Figure 1. Outboard Aft Core Splice Area and Ballast Area Inspection (Sheet 4)**

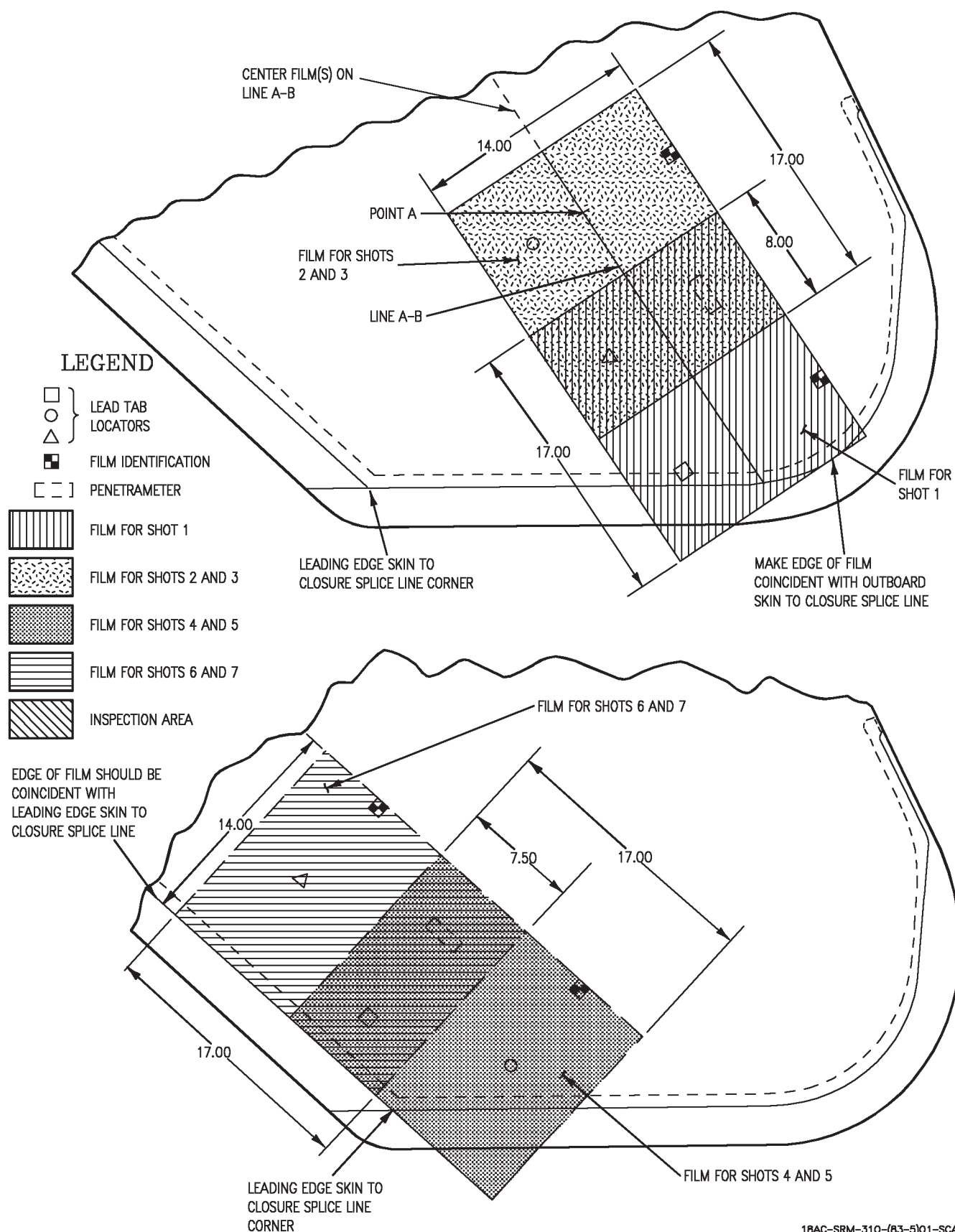


Figure 1. Outboard Aft Core Splice Area and Ballast Area Inspection (Sheet 5)



TECHNIQUE CHART								
SHOT	FILM SIZE	FILM GROUP	SCREEN	PENETRAMETER MIL-STD-453	mA	kVP	EXPOSURE (MINUTES) 1	DENSITY 2
1	14 X 17	AA AND M	NO	0.25AL	5	40	1	1.0 – 3.0
2	14 X 17	AA AND M	NO	0.25AL	5	40	1	1.0 – 3.0
3	14 X 17	AA AND M	NO	0.25AL	5	40	1	1.0 – 3.0
4	14 X 17	AA AND M	NO	0.25AL	5	40	1	1.0 – 3.0
5	14 X 17	AA AND M	NO	0.25AL	5	40	1	1.0 – 3.0
6	14 X 17	AA AND M	NO	0.25AL	5	40	1	1.0 – 3.0
7	14 X 17	AA AND M	NO	0.25AL	5	40	1	1.0 – 3.0
<p style="text-align: center;"><b>LEGEND</b></p> <p>1 INCREASE OR DECREASE EXPOSURE TIME AS REQUIRED TO GET A PREFERRED FILM DENSITY OF 2.0.</p> <p>2 FILM DENSITY OF 2.0 IS PREFERRED.</p>								

Figure 1. Outboard Aft Core Splice Area and Ballast Area Inspection (Sheet 6)

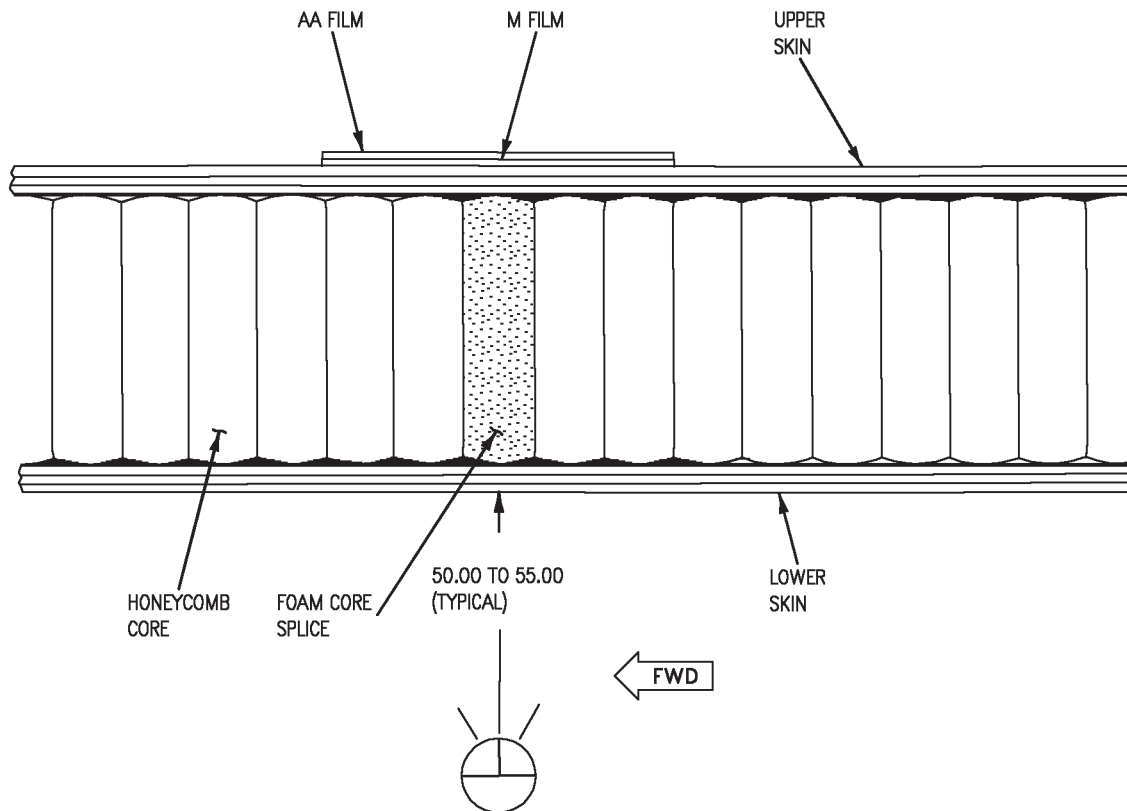


Figure 2. Typical X-Ray Inspection Setup

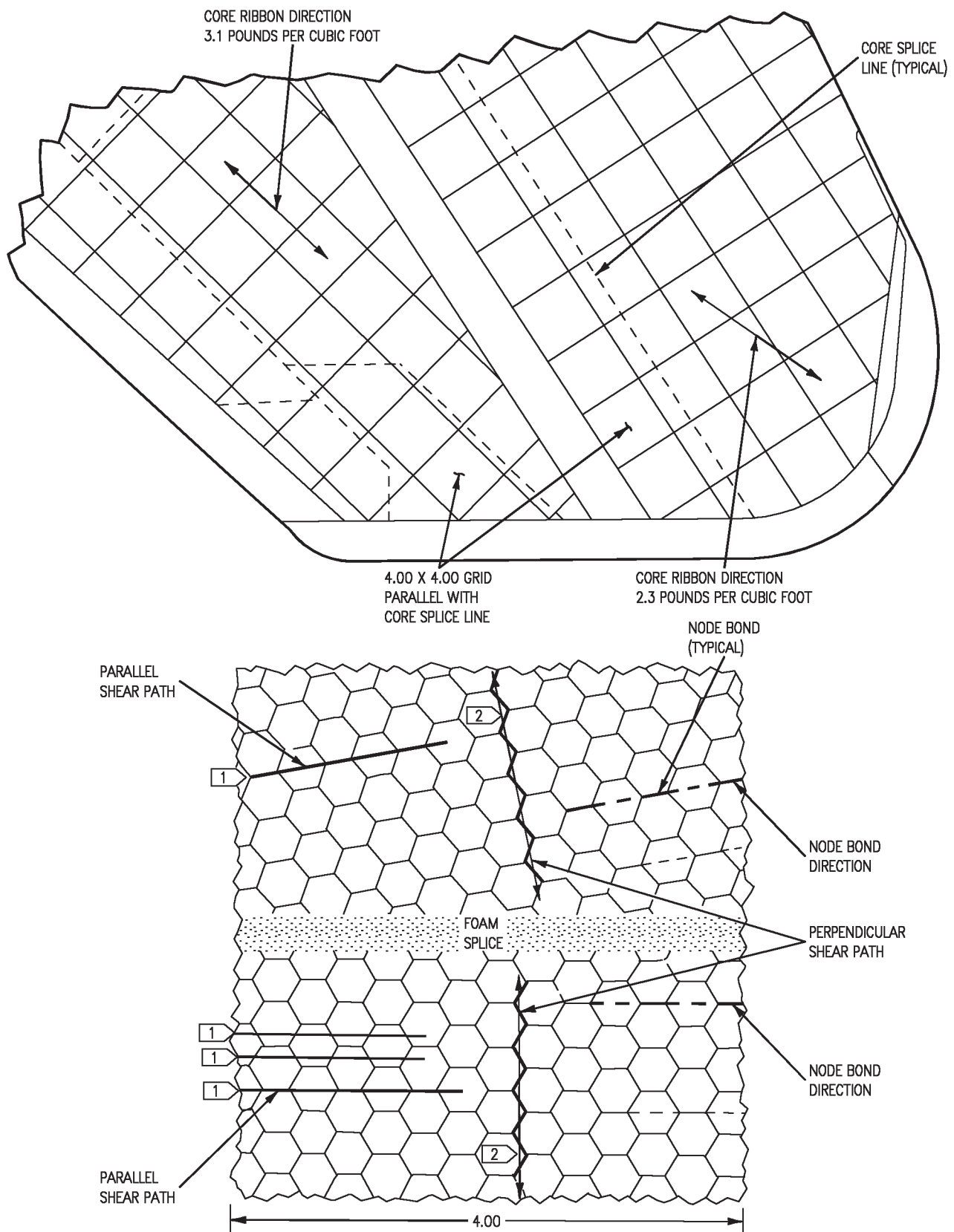


Figure 3. Definition and Examples of Shear Path Failure (Sheet 1)

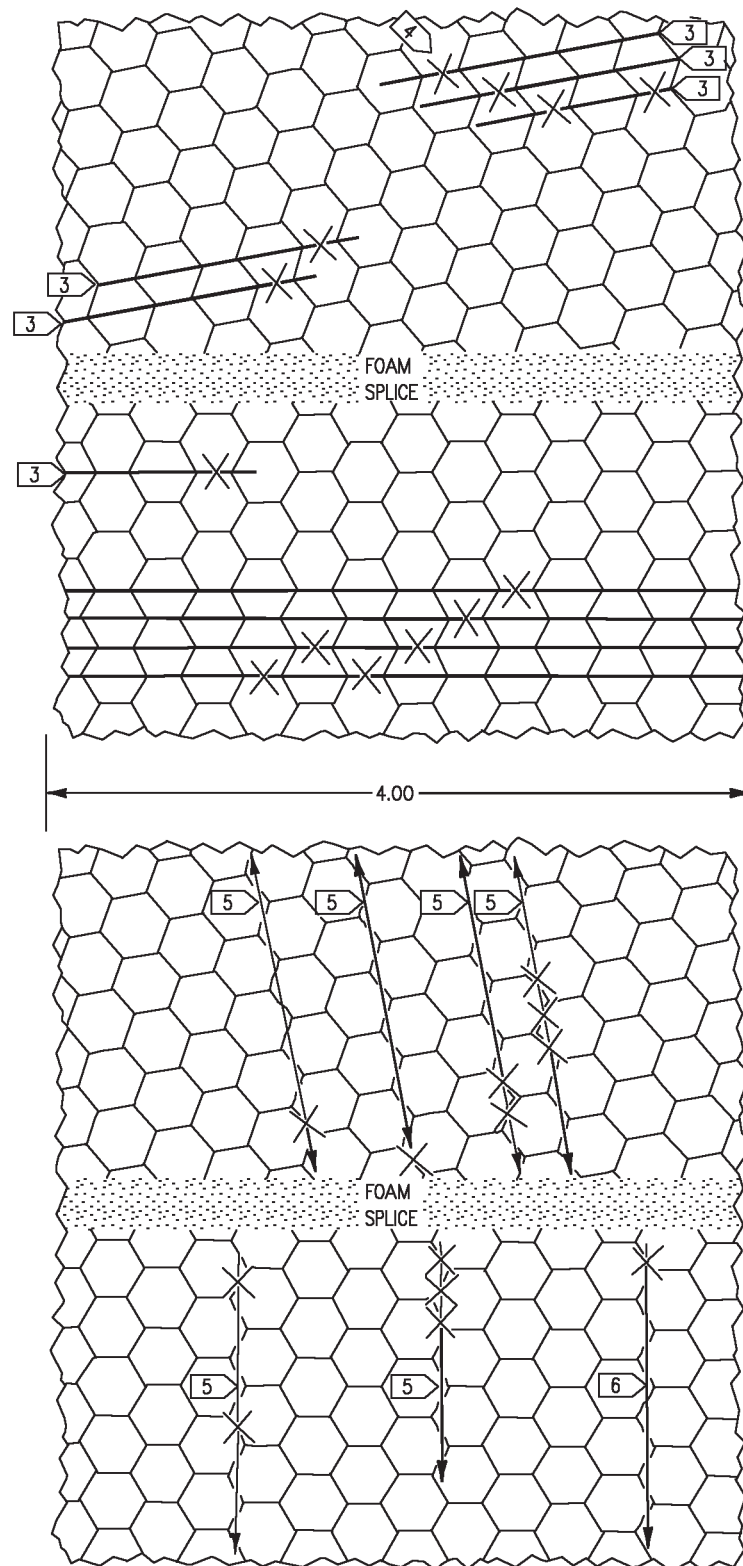
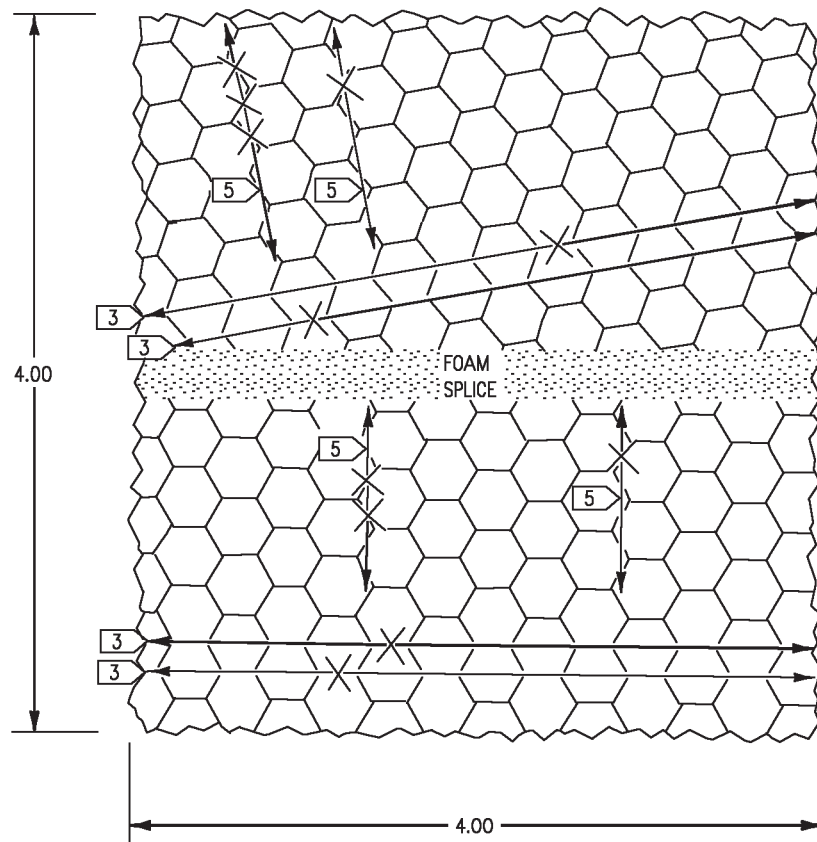


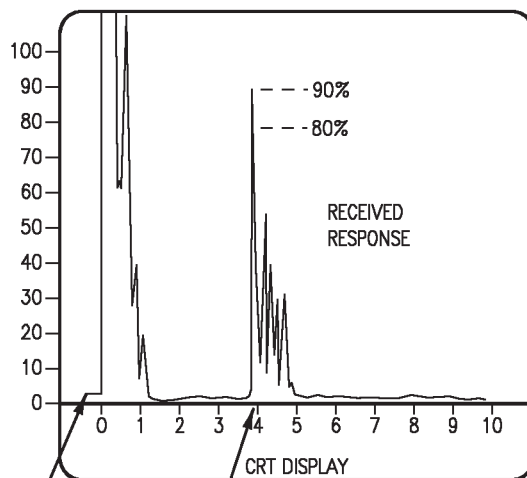
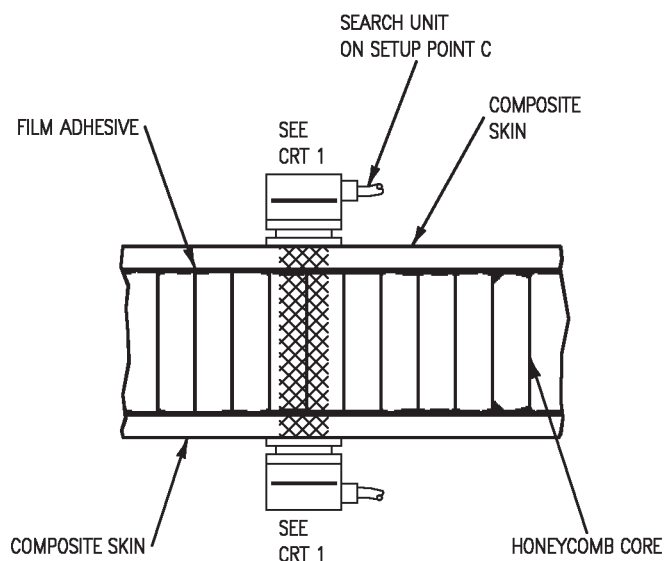
Figure 3. Definition and Examples of Shear Path Failure (Sheet 2)



### LEGEND

- 1 > PARALLEL SHEAR PATH IS ANY LINE PARALLEL TO OR COINCIDENT WITH NODE BOND DIRECTION.
- 2 > PERPENDICULAR SHEAR PATH DIRECTION IS PERPENDICULAR TO NODE BOND DIRECTION.
- 3 > PARALLEL SHEAR PATH FAILURE.
- 4 > X = CELL WALL TEAR OR CRACK (TYPICAL).
- 5 > PERPENDICULAR SHEAR PATH FAILURE.
- 6 > NOT A PERPENDICULAR SHEAR PATH FAILURE.

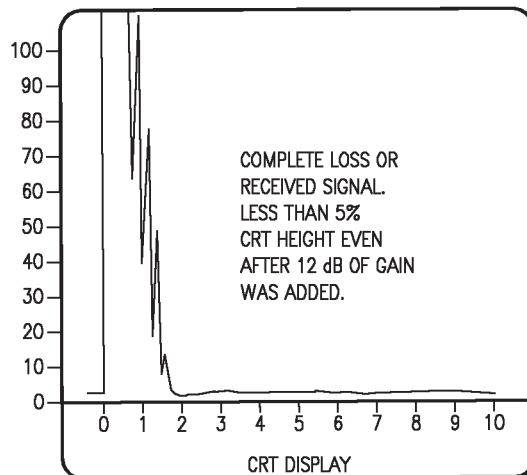
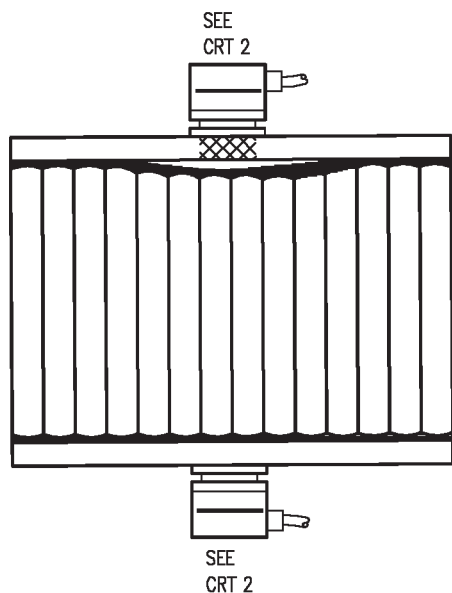
Figure 3. Definition and Examples of Shear Path Failure (Sheet 3)



LEADING EDGE  
OF INITIAL PULSE  
LOCATED AT ZERO

LEADING EDGE OF RECEIVED  
RESPONSE LOCATED AT 4 ON  
THE HORIZONTAL BASELINE.

LOCATION OF RECEIVED RESPONSE  
WILL MOVE ALONG HORIZONTAL BASELINE AS  
ASSEMBLY THICKNESS INCREASES  
OR DECREASES



CRT 2

Figure 4. Ultrasonic Through Transmission Setup and Inspection

## INTERMEDIATE AND DEPOT MAINTENANCE

## NONDESTRUCTIVE INSPECTION

## INSPECTION OF GRAPHITE EPOXY SKIN FOR DELAMINATIONS AT LEADING EDGE OF HORIZONTAL STABILATOR

This WP supersedes WP055 05, dated 1 July 1994.

## Reference Material

Plane Captain Manual .....	A1-F18AC-PCM-000
Naval Aviation Maintenance Program .....	OPNAVINST 4790.2
Nondestructive Inspection.....	A1-F18AC-SRM-300
Ultrasonic through Transmission Contact Testing, Standardization, and Inspection Procedures for Composite Laminate and Metallic Skins Bonded to Honeycomb Core.....	WP008 10
Pulse-Echo Longitudinal, Contact, With Delay Line, For Composite Laminate Materials .....	WP008 12
Aircraft Corrosion Control.....	A1-F18AC-SRM-500
Finish System .....	WP012 00

## Alphabetical Index

Subject	Page No.
Horizontal Stabilator.....	1
Defects .....	1
Documentation .....	4
Post Inspection Cleaning and Corrosion Control.....	4
Primary Inspection Method .....	1

## Record of Applicable Technical Directives

None

1. **HORIZONTAL STABILATOR.** See figures 1 and 2.

2. Horizontal stabilator is bonded honeycomb assembly. Honeycomb core is 0.125, 0.156, 0.188, and 0.250 inch hexagonal cell aluminum alloy. Skin is graphite epoxy with titanium splice plate in spindle area. Structure enclosing core is titanium spars, ribs, and graphite epoxy rib. Surface finish is epoxy primer and polyurethane coatings.

3. **DEFECTS.** Inspect for delaminations on leading edge of horizontal stabilator as shown on figure 1.

4. **PRIMARY INSPECTION METHOD.** Primary inspection method is ultrasonic.

5. **Personnel Qualifications.** Personnel doing this nondestructive inspection should be qualified and certified to do ultrasonic inspections per OPNAVINST 4790.2 SERIES, NDI Technicians NEC 7225/MOS 6044.

6. **Preparation of Aircraft.** No special preparation required.

7. **Access.** No special access required.

### Support Equipment Required

Part Number or Type Designation	Nomenclature
1642AS100-1	Ultrasonic Flaw Detector, MXU- 715/E, Magnaflux
57A2271 OR EQUIVALENT GD0504 OR EQUIVALENT	Microdot to BNC Connecting Cable 0 Degree, 0.25 Inch Diameter, 5 MHz, Delay line Contact Search Unit

### Materials Required

Specification or Part Number	Nomenclature
ULTRAGEL II (CAGE 57869)	Ultrasonic Couplant
GENERIC	Any cleaning solvent locally approved for use on F/A-18 and acceptable per local environmental regulations.
CCC-C-46 TY1 CL4 (CAGE 80244)	Cleaning Cloth
MIL-P-83953-2, TYPE 1, CLASS A or B, BLACK or RED	Aircraft Marking Pencil

#### WARNING

Cleaning solvent may be flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated prolonged contact. Use only in well ventilated areas.

8. **Preparation of Part.** Clean inspection areas with solvent moistened cloth to make sure inspection areas are free of contamination or foreign material.

#### WARNING

Make sure safety precautions for electric, static, grounding when using ultrasonic equipment near aircraft fuel cells, oxygen systems, electrical systems, electronic systems, and stores (A1-F18AC-PCM-000).

### 9. Equipment Settings/Standardization/Setup For Area 1.

- a. Setup ultrasonic flaw detector (tester) per (A1-F18AC-SRM-300, WP008 12), paragraph 5 through 7, steps a. through d. except; COURSE GAIN shall be set at 6.
- b. Apply couplant to small area of skin, over honeycomb core, aft of inspection area 1.
- c. Position search unit on couplant, stabilator.
- d. Adjust GAIN, SWEEP, and DELAY to position back surface response at major division 2.5 on CRT with amplitude of 80 percent.
- e. When tester has been standardized, apply couplant to inspection area 1.
- f. Position search unit on inspection area. Position of back surface response will widen and/or move right of major division 2.5 as sound reflects off back of adhesive and titanium closure. GAIN should be adjusted, lowered, to get 80 percent amplitude.
- g. Do Inspection Procedure, this WP, for inspection area 1.

#### WARNING

### 10. Equipment Settings/Standardization/Setup For Area 2.

- a. Setup tester per (A1-F18AC-SRM-300, WP008 12), paragraph 5 through 7, steps a. through d. except; COURSE GAIN shall be set at 6.
- b. Apply couplant to small area of skin, over honeycomb core, aft of inspection area 2.
- c. Position search unit on couplant, stabilator.



d. Adjust GAIN, SWEEP, and DELAY to position back surface response at major division 4.5 on CRT with amplitude of 80 percent. The position of the response will vary depending on the adjacent skin thickness.

e. When tester has been standardized, apply couplant to inspection area 2.

f. Position search unit on inspection area 2. Position of back surface response will widen and/or move right of major division 4.5 as sound reflects off back of adhesive and titanium closure. The position of the response will vary depending on the adjacent skin thickness. GAIN should be adjusted, lowered, to get 80 percent amplitude.

g. Do Inspection Procedure, this WP, for inspection area 2.

## WARNING

### 11. Equipment Settings/Standardization/Setup For Area 3.

a. Setup tester per (A1-F18AC-SRM-300, WP008 12), paragraph 5 through 7, steps a. through d. except; COURSE GAIN shall be set at 6.

b. Apply couplant to small area of skin, over honeycomb core, aft of inspection area 3.

c. Position search unit on couplant, stabilator.

d. Adjust GAIN, SWEEP, and DELAY to position back surface response at major division 2.5 on CRT with amplitude of 80 percent.

e. Once tester has been standardized, apply couplant to inspection area 3.

f. Position search unit on inspection area 3. Position of back surface response will widen and/or move right of major division 2.5 as sound reflects off back of adhesive and titanium closure. GAIN should be adjusted, lowered, to get 80 percent amplitude.

g. Do Inspection Procedure, this WP, for inspection area 3.

### 12. Equipment Settings/Standardization/Setup For Area 4.

a. Setup tester per (A1-F18AC-SRM-300, WP008 12), paragraph 5 through 7, steps a. through d. except; COURSE GAIN shall be set at 6.

b. Apply couplant to small area of skin, over honeycomb core, aft of inspection area 4.

c. Position search unit on couplant, stabilator.

d. Adjust GAIN, SWEEP, and DELAY to position back surface response at major division 2 on CRT with amplitude of 80 percent. The position of the response will vary depending on the adjacent skin thickness.

e. Once tester has been standardized, apply couplant to inspection area 4.

f. Position search unit on inspection area 4. Position of back surface response will widen and/or move right of major division 2 as sound reflects off back of adhesive and titanium closure. The position of the response will vary depending on the adjacent skin thickness. GAIN should be adjusted, lowered, to get 80 percent amplitude.

g. Do Inspection Procedure, this WP, for inspection area 4.

### 13. Inspection Procedure.

a. Scan upper and lower surfaces of inspection areas 1, 2, 3, or 4.

b. Back surface response will shift to left and amplitude should increase slightly. Back surface response should become more narrow.

c. Edge of delamination can be determined by marking location where CRT response changes.

## NOTE

Do not have sealant removed unless delamination is found.

d. If delamination is found, have sealant removed forward of delamination and inspect both ends to determine true delamination length.

e. If width, forward-to-aft, of delamination is wider than 0.80 inch, do through transmission inspection of skin-to-core areas aft of delamination using (A1-F18AC-SRM-300, WP008 10), to determine if area is also delaminated or unbonded.

An area about 0.25 inch wide aft of titanium closure will not be able to be inspected by through transmission method because of foaming adhesive. See figure 2.

b. Refinish inspection areas, if required (A1-F18AC-SRM-500, WP012 00).

## 14. DOCUMENTATION.

a. If no delamination is found record on documentation sheet similar to figure 3 and give to maintenance.

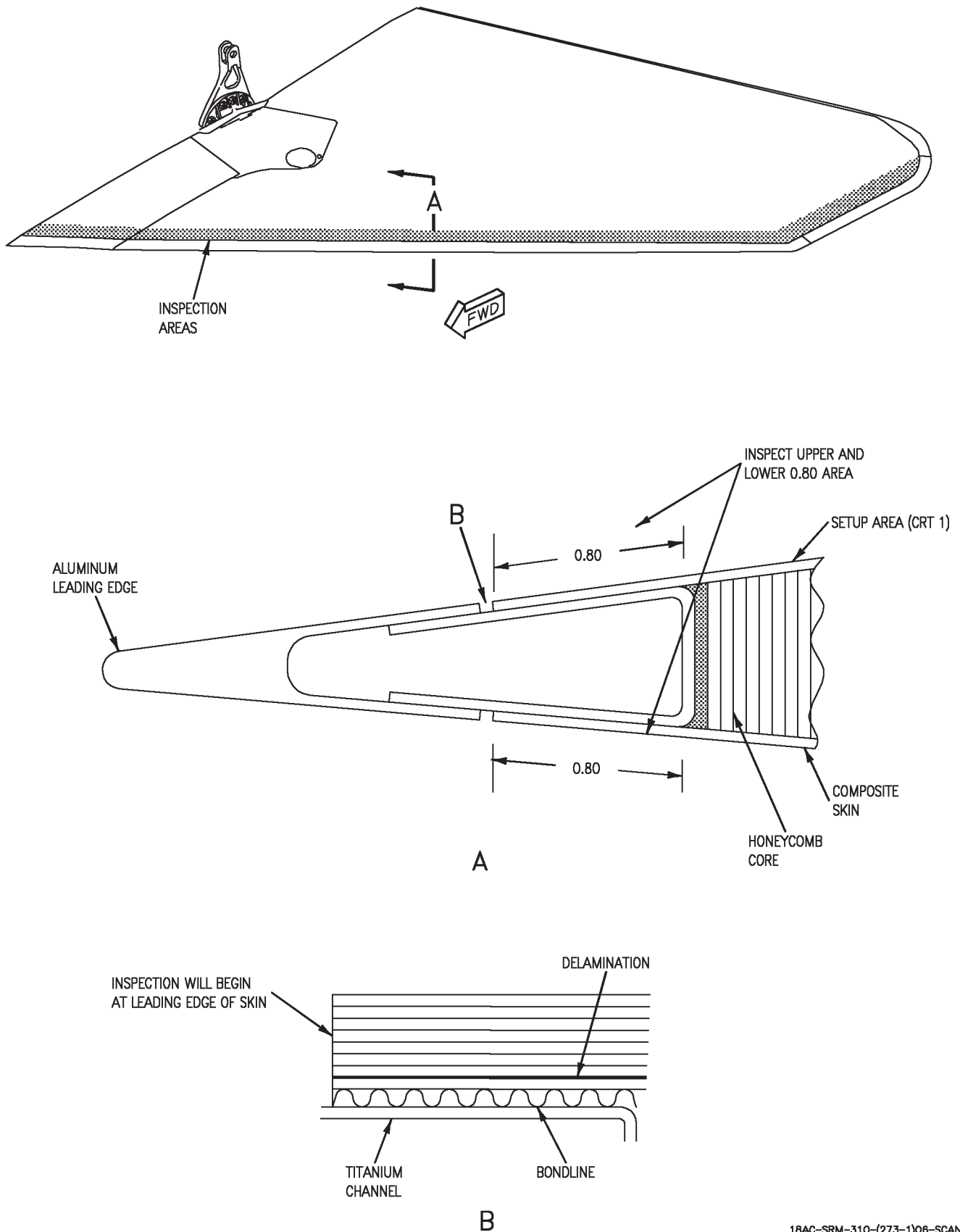
b. If delamination was found document size and location on documentation sheet similar to figure 6. Give one copy to maintenance and one copy to local MCAIR Representative.

### WARNING

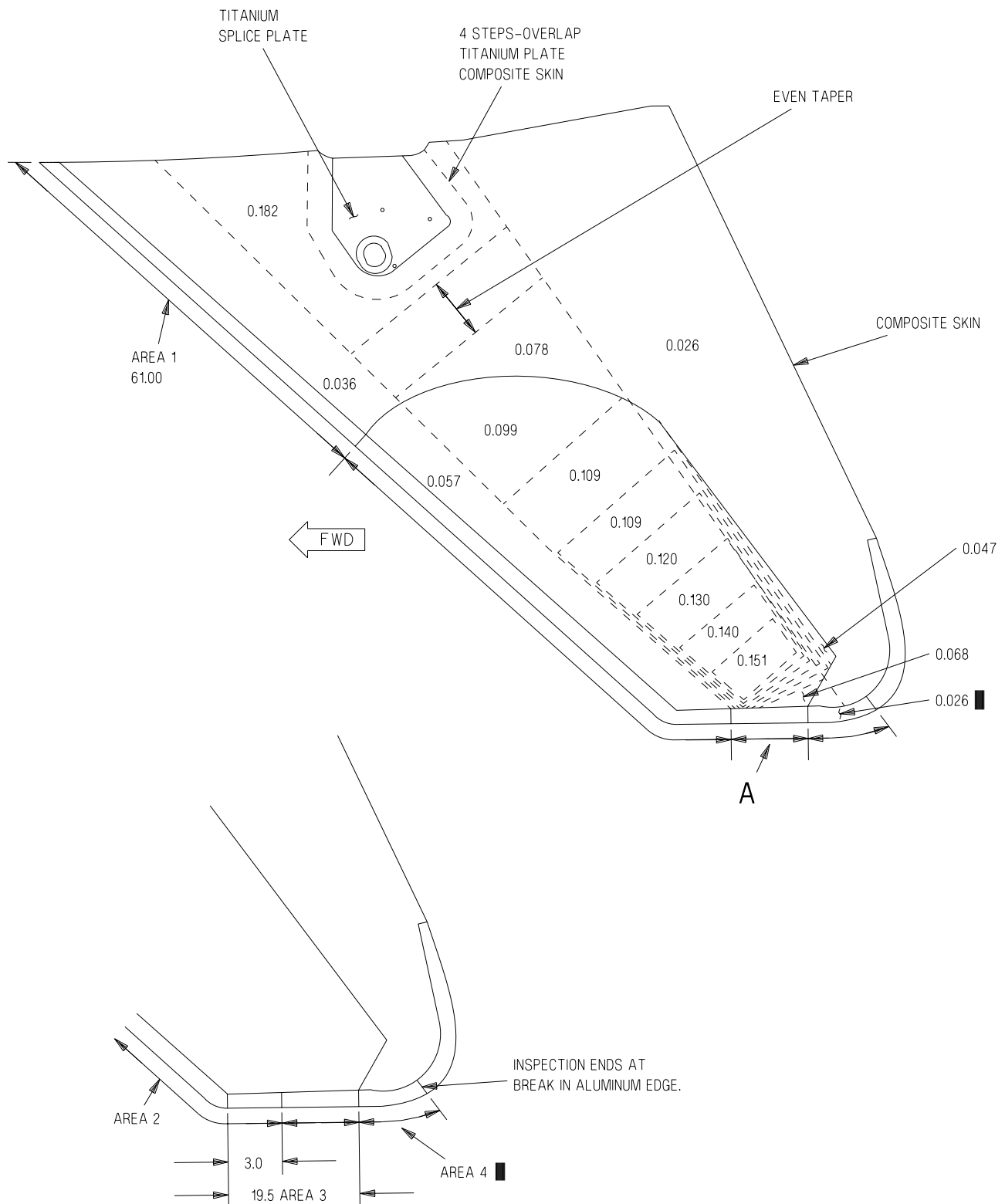
Cleaning solvent may be flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated prolonged contact. Use only in well ventilated areas.

## 15. POST INSPECTION CLEANING AND CORROSION CONTROL.

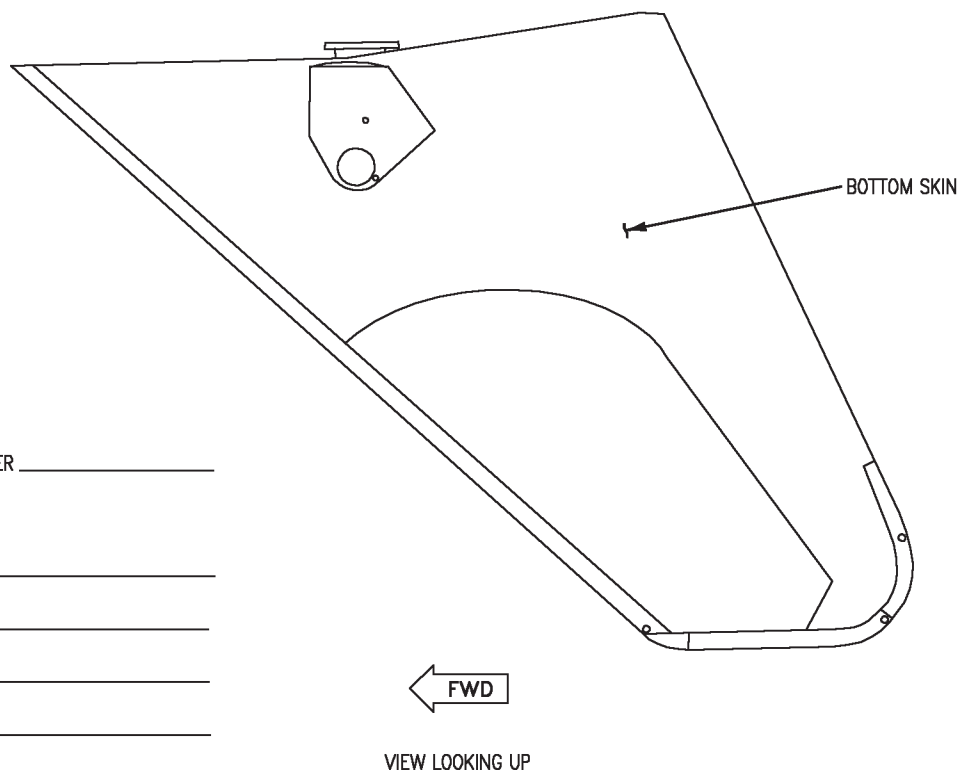
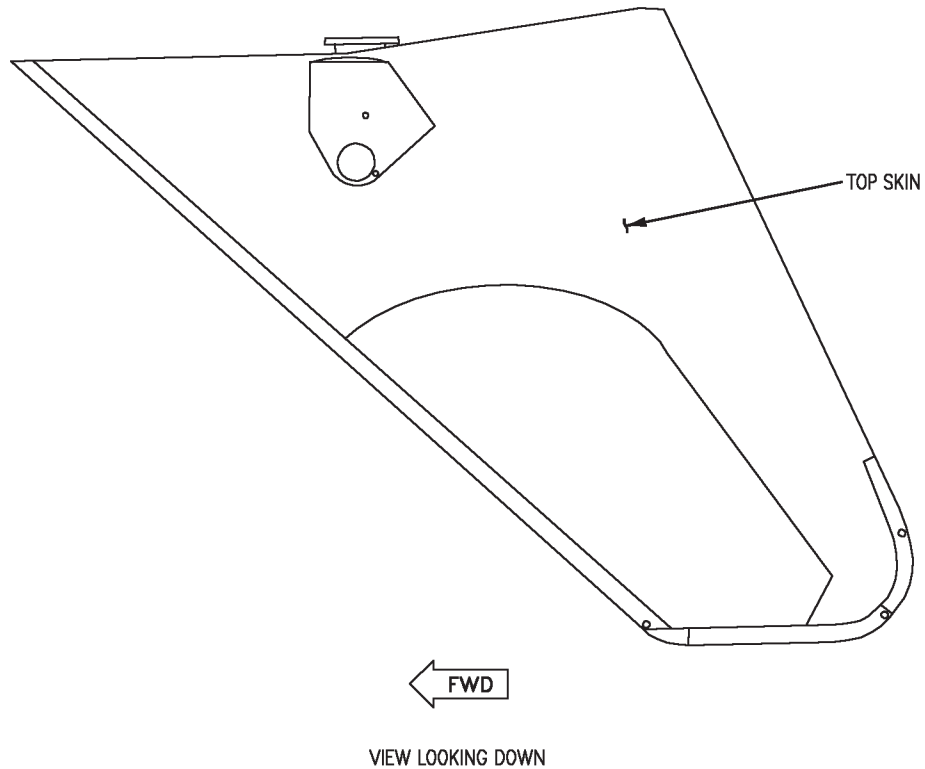
a. Clean inspection material from inspection areas with solvent moistened cloth.



**Figure 1. Inspection Areas**



**Figure 2. Inspection Configuration**



ASSEMBLY NUMBER \_\_\_\_\_

R/H OR L/H \_\_\_\_\_

BUNO \_\_\_\_\_

SQUADRON \_\_\_\_\_

LOCATION \_\_\_\_\_

DATE \_\_\_\_\_

**Figure 3. Documentation**



## INTERMEDIATE MAINTENANCE

## NONDESTRUCTIVE INSPECTION

## VERTICAL STABILIZER LEADING EDGE

## WATER IN HONEYCOMB

## PART NO. 74A230780

## Reference Material

Naval Aviation Maintenance Program .....	OPNAVINST 4790.2
Nondestructive Inspection Methods .....	NAVAIR 01-1A-16
Nondestructive Inspection .....	A1-F18AC-SRM-300
General Inspection .....	WP003 00
Radiographic Method .....	WP005 00

## Alphabetical Index

Subject	Page No.
Vertical Stabilizer Leading Edge .....	1
Defects .....	1
Primary Inspection Method .....	1

## Record of Applicable Technical Directives

None

1. **VERTICAL STABILIZER LEADING EDGE.**

OPNAVINST 4790.2 SERIES, NDI Technicians,  
NEC 7225/MOS 6044.

2. Vertical stabilizer leading edge is bonded honeycomb assembly. Honeycomb core is 0.188 hexagonal cell, 5056 aluminum alloy. Skin enclosing honeycomb core is graphite epoxy and structure is titanium. Surface finish is epoxy primer and polyurethane coating.

3. **DEFECTS.** Inspect for water trapped in honeycomb core. Example of defect is contained in WP003 00.

4. **PRIMARY INSPECTION METHOD.** Primary inspection method is radiographic.

5. **Personnel Qualifications.** Personnel doing this nondestructive inspection should be qualified and certified to do radiographic inspections per

## Support Equipment Required

Part Number or Type Designation	Nomenclature
MIL-STD-453	Penetrameter Set
GXR7-6B	X-ray Apparatus, Portable
072000	X-ray Film Processor
314X	Film Identification Set

**Materials Required****NOTE**

Alternate item type specifications or part numbers are shown indented.

**Specification  
or Part Number****Nomenclature**

INDUSTREX M FILM CODE M2	Radiographic Film, X-ray Film, 14x17
INDUSTREXAA FILM CODE AA2 14x17	Radiographic Film, X-ray Film, 14x17
MIL-P-83953-2, TYPE 1, CLASS A or B, RED or BLACK	Aircraft Marking Pencil
A-A-883, TYPE 1	Pressure Sensitive Tape, Masking Tape

6. **Preparation of Aircraft.** No special preparation required.

7. **Access.** No special access required.

8. **Preparation of Part.** No special preparation required.

**WARNING****HIGH RADIATION**

Make sure applicable safety precautions in WP005 00 and NAVAIR 01-1A-16 are complied with. Failure to comply may result in injury to personnel.

**9. Equipment Settings/Standardization/Setup.**

Set X-ray unit per data contained in technique chart, see figure 1.

**10. Inspection Procedure.****NOTE**

X-ray film for shots are double loaded.  
AA film is located next to part and both films are exposed simultaneously.

a. Locate films 1 and 2 for shot 1. Film should be taped to inboard surface of leading edge with identification markers taped to source side of film pack and penetrameters taped to source side of leading edge.

b. Locate source to aiming point for shot 1. Source should be normal to aiming point.

c. Expose films 1 and 2 using technique chart settings for shot 1. Remove exposed film.

d. Repeat steps a through c for films 3 and 4 and shot 2.

e. Repeat steps a through c for films 5 and 6 and shot 3.

f. Repeat steps a through c for films 7 and 8 and shot 4.

g. Repeat steps a through c for films 9 and 10 and shot 5.

h. Repeat steps a through c for films 11 and 12 and shot 6.

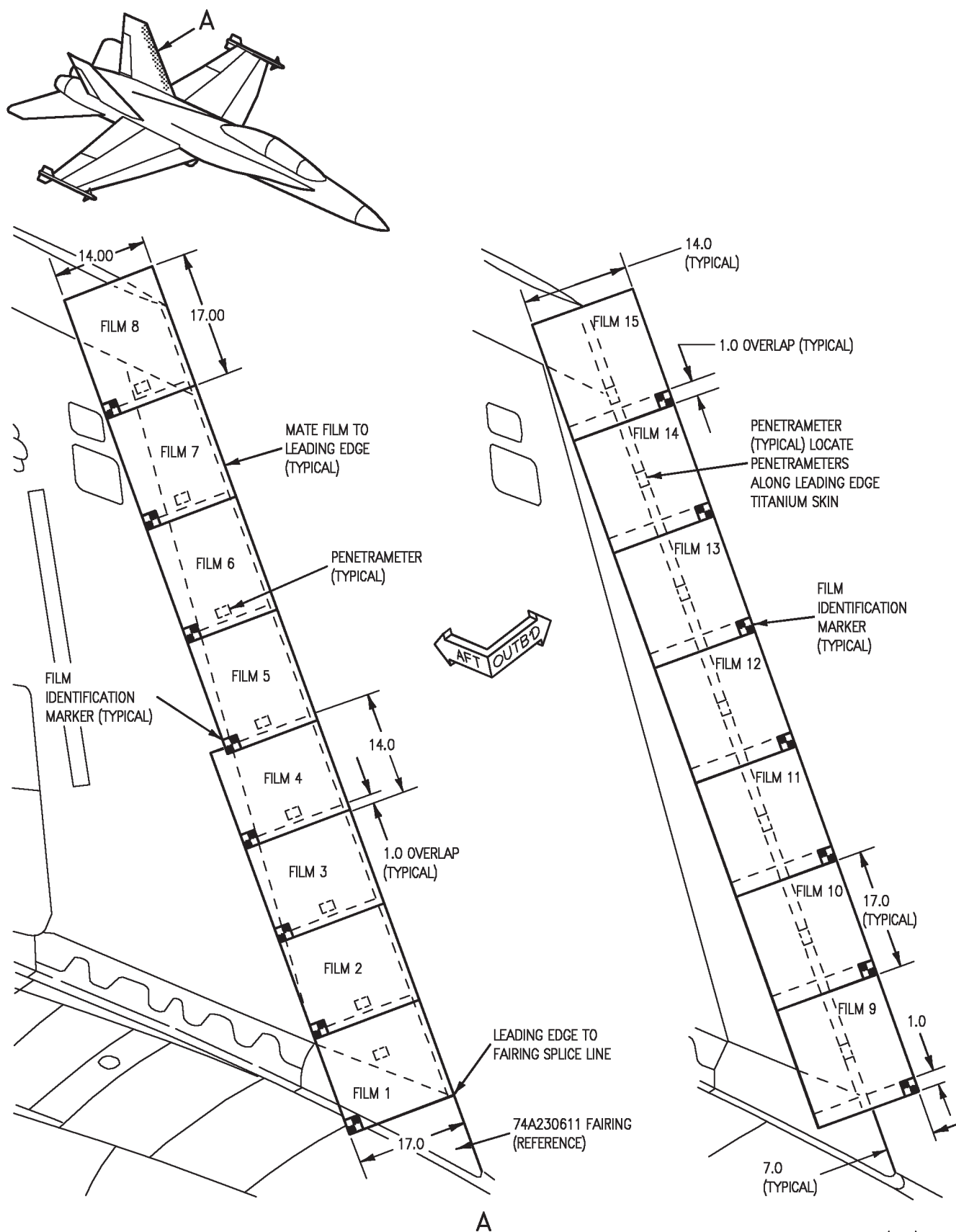
i. Repeat steps a through c for films 13 and 14 and shot 7.

j. Repeat steps a through c for film 15 and shot 8.

k. Process exposed film. Interpret radiographs for water trapped in honeycomb core (WP005 00).

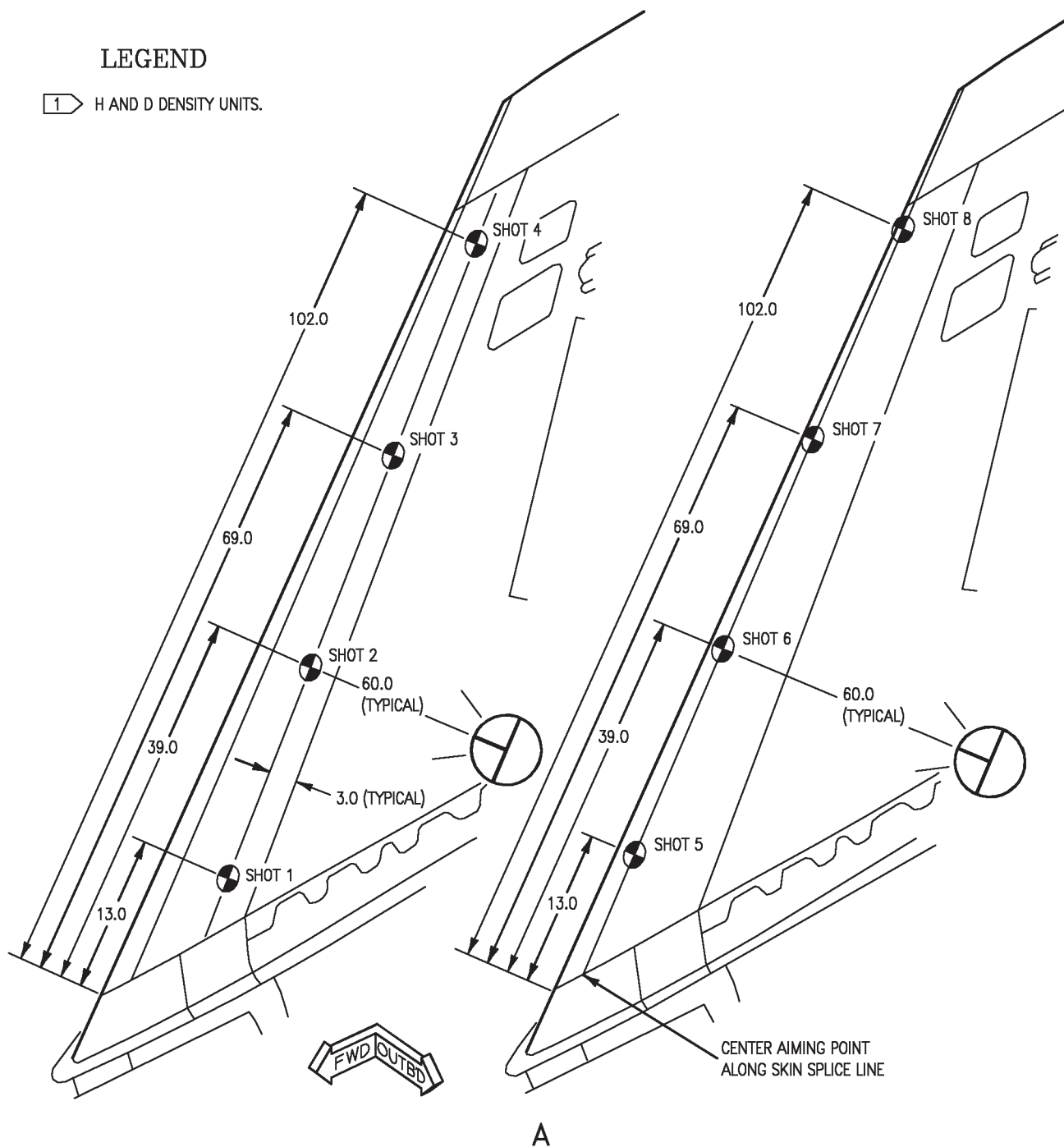
l. Mark defect(s) with aircraft marking pencil.





## LEGEND

1 H AND D DENSITY UNITS.



TECHNIQUE CHART								
SHOT	FILM SIZE	FILM GROUP	BACK SCREEN	PENETRATOR MIL-STD-453	mA	KVP	EXPOSURE (MINUTES)	1 DENSITY
1 THRU 4	14 X 17	AA AND M	0.010 Pb	0.25 L	2.5	40	2	1.0 - 3.5
5 THRU 8	14 X 17	AA AND M	0.010 Pb	0.25 Ti	2.5	60	2	1.0 - 3.5

Figure 1. Vertical Stabilizer Leading Edge, Water in Honeycomb (Sheet 2)

## INTERMEDIATE MAINTENANCE

## NONDESTRUCTIVE INSPECTION

## VERTICAL STABILIZER TIP

## WATER IN HONEYCOMB

## PART NO. 74A230850

## Reference Material

Naval Aviation Maintenance Program .....	OPNAVINST 4790.2
Nondestructive Inspection Methods .....	NAVAIR 01-1A-16
Nondestructive Inspection .....	A1-F18AC-SRM-300
General Information .....	WP003 00
Radiographic Method .....	WP005 00

## Alphabetical Index

Subject	Page No.
Vertical Stabilizer Tip .....	1
Defects .....	1
Primary Inspection Method .....	1

## Record of Applicable Technical Directives

None

## 1. VERTICAL STABILIZER TIP.

NEC 7225/MOS 6044.

2. Vertical stabilizer tip is bonded honeycomb assembly. Honeycomb core is 0.250 hexagonal cell, 5056 aluminum alloy. Skin enclosing honeycomb core is glass epoxy laminate. Surface finish is epoxy primer and polyurethane coating.

3. **DEFECTS.** Inspect for water trapped in honeycomb core. Example of defect is contained in WP003 00.

4. **PRIMARY INSPECTION METHOD.** Primary inspection method is radiographic.

5. **Personnel Qualifications.** Personnel doing this nondestructive inspection should be qualified and certified to do radiographic inspections per OPNAVINST 4790.2 SERIES, NDI Technicians,

## Support Equipment Required

Part Number or Type Designation	Nomenclature
MIL-STD-453	Penetrameter Set
GXR7-6B	X-ray Apparatus, Portable
072000	X-ray Film Processor
314X	Film Identification Set

**Materials Required**

Specification or Part Number	Nomenclature
INDUSTREX M FILM CODE M2	Radiographic Film, X-ray Film, 14x17
INDUSTREXAA FILM CODE AA2 14x17	Radiographic Film, X-ray Film, 14x17
MIL-P-83953-2, TYPE 1, CLASS A or B, RED or BLACK	Aircraft Marking Pencil
A-A-883, TYPE 1	Pressure Sensitive Tape, Masking Tape

6. **Preparation of Aircraft.** No special preparation required.

7. **Access.** No special access required.

8. **Preparation of Part.** No special preparation required.

**WARNING****HIGH RADIATION**

Make sure applicable safety precautions in WP005 00 and NAVAIR 01-1A-16 are complied with. Failure to comply may result in injury to personnel.

**9. Equipment Settings/Standardization/Setup.**

Set X-ray unit per data contained in technique chart, see figure 1.

**10. Inspection Procedure.****NOTE**

X-ray film for shots are double loaded. AA film is located next to part and both films exposed simultaneously.

a. Locate films 1 and 2 for shot 1. Film should be taped to inboard surface of tip with identification markers taped to source side of film pack and penetrameters taped to source side of tip.

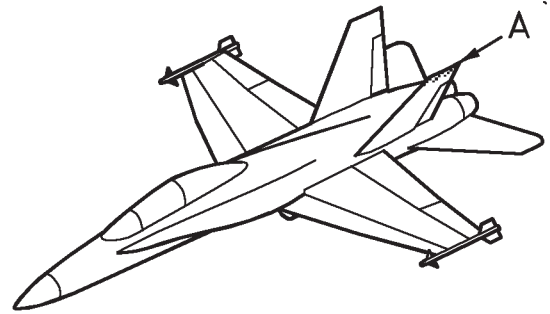
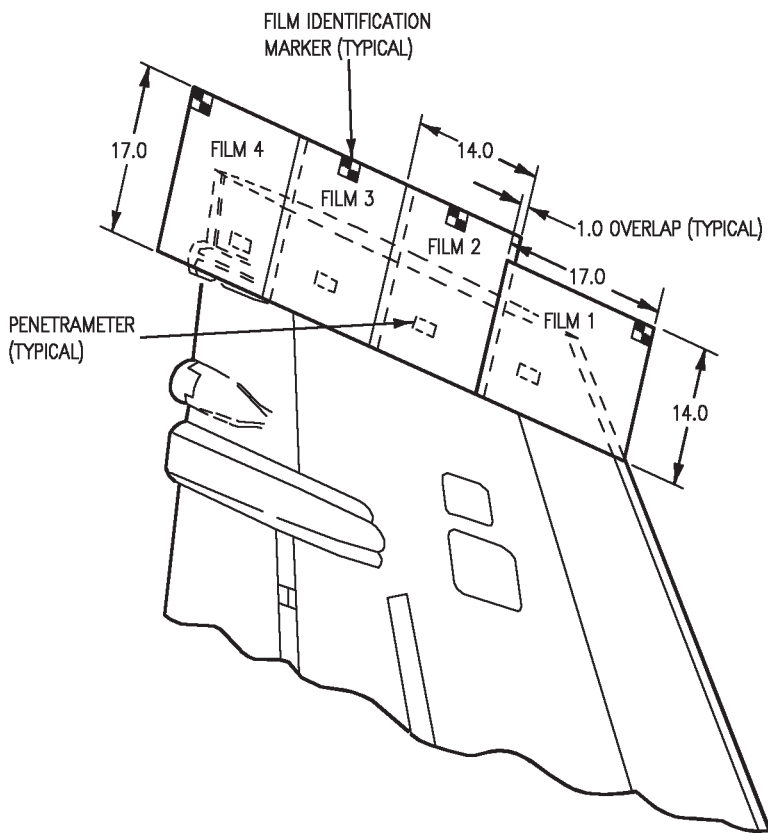
b. Locate source to aiming point for shot 1. Source should be normal to aiming point.

c. Expose films 1 and 2 using technique chart settings for shot 1. Remove exposed film.

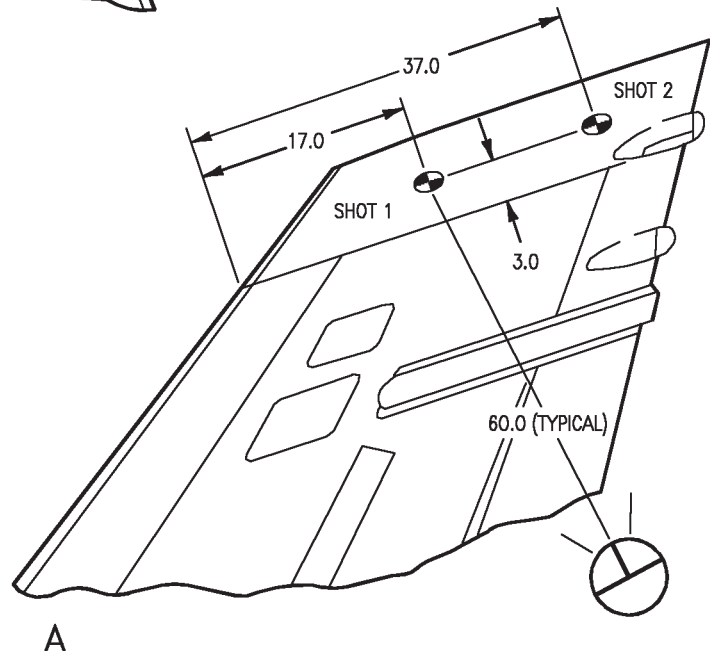
d. Repeat steps a through c for films 3 and 4 and shot 2.


e. Process exposed film. Interpret radiographs for water trapped in honeycomb core (WP005 00).

f. Mark defect(s) using aircraft marking pencil.



**LEGEND**  
 H AND D DENSITY UNITS.



TECHNIQUE CHART								
SHOT	FILM SIZE	FILM GROUP	BACK SCREEN	PENETRATOR MIL-STD-453	mA	kVP	EXPOSURE (MINUTES)	 DENSITY
1 AND 2	14 X 17	AA AND M	0.10Pb	0.25 AL	2.5	50	2	1.0 - 3.5

**Figure 1. Vertical Stabilizer Tip, Water in Honeycomb**



## INTERMEDIATE MAINTENANCE

## NONDESTRUCTIVE INSPECTION

## VERTICAL STABILIZER TRAILING EDGE

## WATER IN HONEYCOMB

## PART NO. 74A230790

## Reference Material

Naval Aviation Maintenance Program .....	OPNAVINST 4790.2
Nondestructive Inspection Methods .....	NAVAIR 01-1A-16
Nondestructive Inspection .....	A1-F18AC-SRM-300
General Information .....	WP003 00
Radiographic Method .....	WP005 00

## Alphabetical Index

Subject	Page No.
Vertical Stabilizer Trailing Edge .....	1
Defects .....	1
Primary Inspection Method .....	1

## Record of Applicable Technical Directives

None

1. **VERTICAL STABILIZER TRAILING EDGE.**

OPNAVINST 4790.2 SERIES, NDI Technicians,  
NEC 7225/MOS 6044.

2. Vertical stabilizer trailing edge is bonded honeycomb assembly. Honeycomb core is 0.250 hexagonal cell, 5056 aluminum alloy. Skin enclosing the honeycomb core is graphite epoxy laminate and structure is titanium. Surface finish is epoxy primer and polyurethane coating.

3. **DEFECTS.** Inspect for water trapped in honeycomb core. Example of defect is contained in WP003 00.

4. **PRIMARY INSPECTION METHOD.** Primary inspection method is radiographic.

5. **Personnel Qualifications.** Personnel doing this nondestructive inspection should be qualified and certified to do radiographic inspections per

## Support Equipment Required

Part Number or Type Designation	Nomenclature
MIL-STD-453	Penetrameter Set
GXR7-6B	X-ray Apparatus, Portable
0721500	X-ray Film Processor
314X	Film Identification Set

**Materials Required****Specification  
or Part Number****Nomenclature**

INDUSTREX M FILM CODE M2	Radiographic Film, X-ray Film, 14 x 17
INDUSTREXAA FILM CODE AA2 14x17	Radiographic Film, X-ray Film, 14 x 17
MIL-P-83953-2, TYPE 1, CLASS A or B, RED or BLACK	Aircraft Marking Pencil
A-A-883, TYPE 1	Pressure Sensitive Tape, Masking Tape

6. **Preparation of Aircraft.** No special preparation required.

7. **Access.** No special access required.

8. **Preparation of Part.** No special preparation required.

**WARNING****HIGH RADIATION**

Make sure applicable safety precautions in WP005 00 and NAVAIR 01-1A-16 are complied with. Failure to comply may result in injury to personnel.

**9. Equipment Settings/Standardization/Setup.**

Set X-ray unit per data contained in technique chart, see figure 1.

**10. Inspection Procedure.****NOTE**

X-ray film for shot is double loaded. AA film is located next to part and both films are exposed simultaneously.

a. Locate film 1 for shot 1. Film should be taped to inboard surface of trailing edge with identification marker taped to source side of film pack and penetrometer taped to source side of trailing edge.

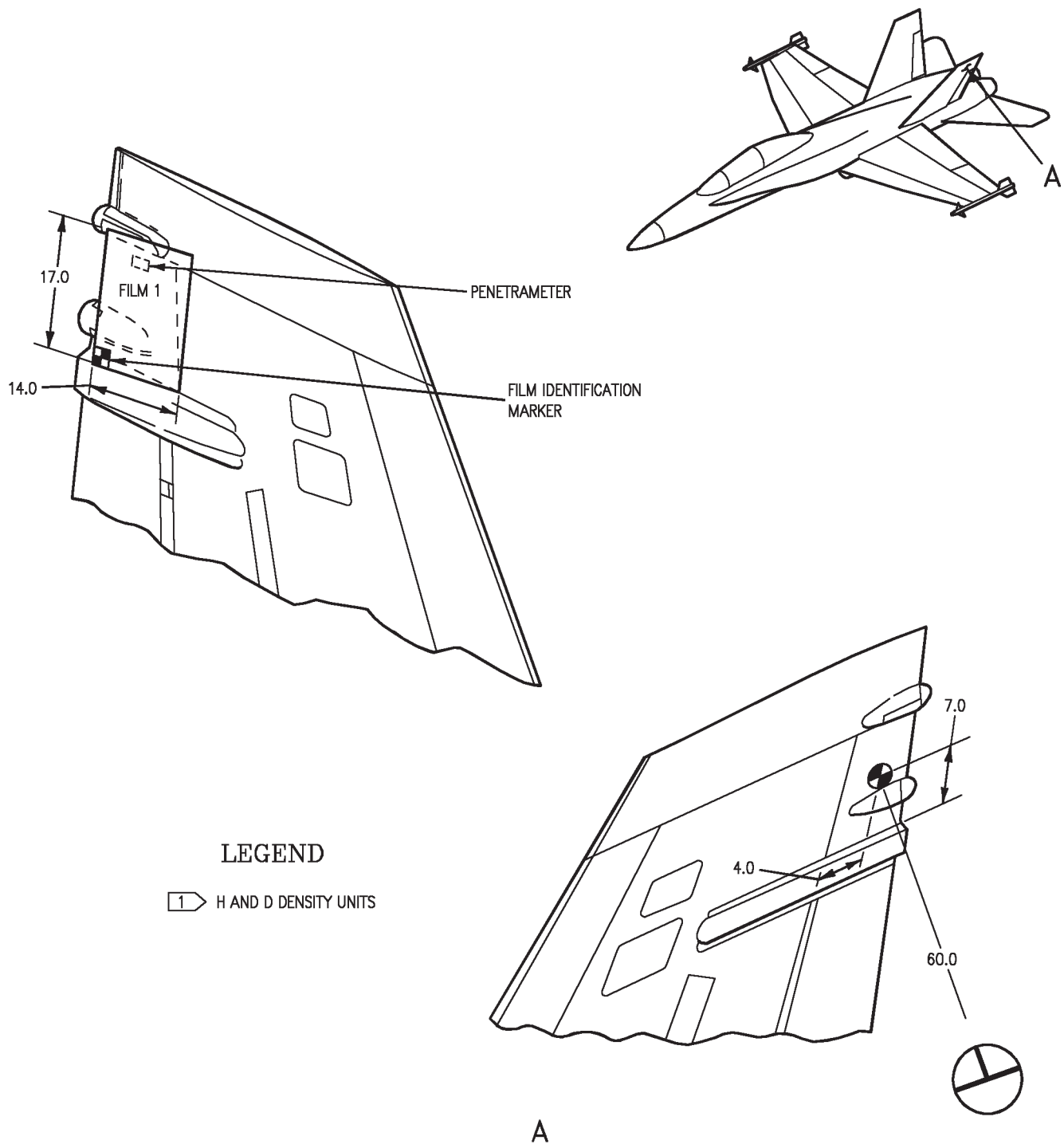
b. Locate source to aiming point for shot 1. Source should be normal to aiming point.

c. Expose film 1 using technique chart setting for shot 1.

d. Process exposed film. Interpret radiograph for water trapped in honeycomb core (WP005 00).

e. Mark defect(s) using aircraft marking pencil.





TECHNIQUE CHART								
SHOT	FILM SIZE	FILM GROUP	BACK SCREEN	PENETRATOR MIL-STD-453	mA	KVP	EXPOSURE (MINUTES)	<span style="border: 1px solid black; padding: 2px;">1</span> DENSITY
1	14 X 17	AA AND M	0.010Pb	0.25AL	2.5	40	2	1.0-3.5

**Figure 1. Vertical Stabilizer Trailing Edge, Water in Honeycomb**



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**NONDESTRUCTIVE INSPECTION****VERTICAL STABILIZER TRAILING EDGE ASSEMBLY****COMPOSITE LAMINATE SKIN TO TITANIUM CLOSURE, UNBONDS; AND COMPOSITE LAMINATE SKIN  
DELAMINATIONS****PART NO. 74A230790**

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**Reference Material**

Naval Aviation Maintenance Program .....	OPNAVINST 4790.2
Nondestructive Inspection.....	A1-F18AC-SRM-300
General Information .....	WP003 00
Pulse Echo, Longitudinal Wave Contact, with Delay Line, for Composite Laminate Material Up to 0.190 Inch .....	WP008 03
Ultrasonic Through Transmission Contact Testing, Standardization, and Inspection Procedures for Composite Laminate Skins Bonded to Honeycomb Core.....	WP008 01
Pulse-Echo, Longitudinal Wave Contact, with Delay Line, for Composite Laminate Material Bonded to Honeycomb Core .....	WP008 04
Ultrasonic Through Transmission Contact Testing, Standardization, and Inspection Procedures for Composite Laminate and Metallic Skins Bonded to Honeycomb Core .....	WP008 10
Pulse-Echo Longitudinal, Contact, With Delay Line, for Composite Laminate Materials.....	WP008 12
Pulse-Echo Longitudinal, Contact, With Delay Line, for Composite Laminate Material Bonded to Honeycomb Core .....	WP008 13
Plane Captain Manual .....	A1-F18AC-PCM-000

**Alphabetical Index**

<b>Subject</b>	<b>Page No.</b>
Vertical Stabilizer Trailing Edge Assembly .....	2
Defects .....	2
Post Inspection Cleaning and Corrosion Control.....	5
Primary Inspection Method .....	2
Ultrasonic Method Using C-398 Ultrasonic Flaw Detector .....	2
Ultrasonic Method Using MXU-715/E Ultrasonic Flaw Detector .....	3

**Record of Applicable Technical Directives**

None

## 1. VERTICAL STABILIZER TRAILING EDGE ASSEMBLY.

2. Vertical stabilizer trailing edge assembly (trailing edge assembly), see figure 1, is bonded honeycomb assembly. Honeycomb core is 0.125 and 0.1875 hexagonal cell, 5056 aluminum alloy. Structure enclosing core is graphite epoxy skins bonded to titanium closures. Skin to core and skin to closure bonds are made with FM-300 film adhesive. Trailing edge closure is filled with proseal 840 sealant. Surface finish is epoxy primer and polyurethane coatings.

3. **DEFECTS.** Inspect for composite laminate skin to titanium closure unbonds and composite laminate skin delaminations. Examples of skin to closure unbonds and delaminations are contained in (WP003 00).

4. **PRIMARY INSPECTION METHOD.** Primary inspection methods are ultrasonic pulse-echo and through transmission.

5. **Personnel Qualifications.** Personnel doing this nondestructive inspection should be qualified and certified to do ultrasonic inspections per OPNAVINST 4790.2 SERIES, NDI Technicians, NEC 7225/MOS 6044.

6. **Preparation of Aircraft.** No special preparation required.

7. **Access.** No special access required.

## 8. ULTRASONIC METHOD USING C-398 ULTRASONIC FLAW DETECTOR.

### Support Equipment Required

Part Number or Type Designation	Nomenclature
C-398 (303B)	Ultrasonic Flaw Detector
57A2271 or EQUIVALENT	Microdot to BNC Connecting Cable, 2 Req'd.
57A2276 or EQUIVALENT	0°, 0.500 Dia., 2.25 MHz, Contact, Delay Line, Search Unit, 2 Req'd.

### Support Equipment Required (Continued)

Part Number or Type Designation	Nomenclature
GD0504	0°, 0.25 Dia., 5 MHz, Contact, Delay Line, Search Unit
74D110175-1001	Graphite Epoxy Reference Standard Set:
74D111295-1009	Graphite Epoxy Flat Bottom Hole Reference Standard for Laminates up to 0.450 Inch
74D111295-1005	Honeycomb Reference Standard with Graphite Epoxy Skin for Sandwich Assemblies Less Than 1 Inch

### Materials Required

#### NOTE

Alternate item specifications or part numbers are shown indented.

Specification or Part Number	Nomenclature
ULTRAGEL II	Couplant
P-D-680, TYPE 2	Dry Cleaning Solvent
D 1153	Methyl Isobutyl Ketone
MIL-P-83953-2, TYPE 1, CLASS A OR B, RED OR BLACK	Aircraft Marking Pencil
CC-C-46, TYPE I, CLASS 4	Cleaning Cloth

## 9. Preparation of Part.

### WARNING

1,1,1-Trichloroethane is toxic to eyes, skin, and respiratory tract. Skin and eye protection is required. Avoid repeated or prolonged contact. Good general ventilation is normally enough.

a. Clean inspection area(s) with water moistened cloth, or solvent, as required, to make sure inspection area(s) is free of contamination or foreign material.

b. On trailing edge assembly, locate, mark, and identify inspection area(s) shown in figure 2.

### WARNING

Make sure safety precautions have been met for electrical, static, grounding when using ultrasonic equipment near aircraft fuel cells, oxygen systems, electronic systems, and stores (A1-F18AC-PCM-000).

**10. Equipment Settings/Standardization/Setup For Solid Composite Laminate Bonded to Titanium Closure.** Using GD0504 contact delay line search unit, do Equipment Settings/Standardization/Setup (WP008 03).

**11. Inspection Procedure For Solid Composite Laminate Bonded to Titanium Closure Areas.** Do Pulse-Echo Ultrasonic Inspection on Composite Laminate Bonded to Titanium Closure (WP008 03) and as below:

a. Make sure skin to closure interface and back response are at correct location on horizontal baseline when back response is at 80 to 90 percent CRT height, see figure 3, CRT 1.

b. For inspection responses in addition to those described in (WP008 03), see figure 3, CRT's 2, 3, and 4.

c. Use pulse-echo mapping (WP008 03) to determine extent of flaw indications.

**12. Equipment Settings/Standardization/Setup For Skin to Core Areas.** See figure 4. Do Equipment Settings/Standardization/Setup (WP008 01), except as below:

a. Use two 57A2276 contact search units.

b. Use P-2 calibration point on 74D111295-1005 honeycomb reference standard.

**13. Inspection Procedure For Skin to Core Areas.** Do inspection of skin to core areas (WP008 01) and as below:

a. Use two 57A2276 contact search units.

b. Apply couplant to both surfaces of inspection area(s).

c. Make sure initial pulse width does not interfere with location of received response. If required, switch position of search units on microdot connecting cables, or use different search unit on receiver cable.

d. Use ultrasonic pulse-echo inspection (WP008 04) to determine if suspect areas are result of skin delaminations.

e. Do pulse-echo inspection on both mold line surfaces to help identify location of flaws causing through transmission unbond response. See figure 1 to identify skin thickness in marked area.

f. Do paragraph 20.

### 14. ULTRASONIC METHOD USING MXU-715/E ULTRASONIC FLAW DETECTOR.

### Support Equipment Required

Part Number or Type Designation	Nomenclature
1642AS100-1	Ultrasonic Flaw Detector, MXU-715/E, Magnaflux
57A2271 or EQUIVALENT	Microdot to BNC Connecting Cable, 2 Req'd.
57A2276 or EQUIVALENT	0°, 0.500 Dia., 2.25 MHz, Contact, Delay Line, Search Unit, 2 Req'd.
GD0504	0°, 0.25 Dia., 5 MHz, Contact, Delay Line, Search Unit
74D110175-1001	Graphite Epoxy Reference Standard Set:

### Support Equipment Required (Continued)

Part Number or Type Designation	Nomenclature
74D111295-1009	Graphite Epoxy Flat Bottom Hole Reference Standard for Laminates up to 0.450 Inch
74D111295-1005	Honeycomb Reference Standard with Graphite Epoxy Skin for Sandwich Assemblies Less Than 1 Inch

### Materials Required

#### NOTE

Alternate item specifications or part numbers are shown indented.

Specification or Part Number	Nomenclature
ULTRAGEL II P-D-680, TYPE 2 D 1153	Couplant Dry Cleaning Solvent Methyl Isobutyl Ketone
MIL-P-83953-2, TYPE 1, CLASS A OR B, RED OR BLACK	Aircraft Marking Pencil
CC-C-46, TYPE I, CLASS 4	Cleaning Cloth

#### 15. Preparation of Part.

#### WARNING

1,1,1-Trichloroethane is toxic to eyes, skin, and respiratory tract. Skin and eye protection is required. Avoid repeated or prolonged contact. Good general ventilation is normally enough.

a. Clean inspection area(s) with water moistened cloth, or solvent, as required, to make sure inspection area(s) is free of contamination or foreign material.

b. On trailing edge assembly, locate, mark, and identify inspection area(s) shown in figure 2.

#### WARNING

Make sure safety precautions have been met for electrical, static, grounding when using ultrasonic equipment near aircraft fuel cells, oxygen systems, electronic systems, and stores (A1-F18AC-PCM-000).

16. **Equipment Settings/Standardization/Setup For Solid Composite Laminate Bonded to Titanium Closure.** Using GD0504 contact delay line search unit, do Equipment Settings/Standardization/Setup (WP008 12).

17. **Inspection Procedure For Solid Composite Laminate Bonded to Titanium Closure Areas.** Do Pulse-Echo Ultrasonic Inspection on Composite Laminate Bonded to Titanium Closure (WP008 12) and as below:

a. Make sure skin to closure interface and back response are at correct location on horizontal baseline when back response is at 80 to 90 percent CRT height, see figure 3, CRT 1.

b. For inspection responses in addition to those described in (WP008 12), see figure 3, CRT's 2, 3, and 4.

c. Use pulse-echo mapping (WP008 12) to determine extent of flaw indications.

18. **Equipment Settings/Standardization/Setup For Skin to Core Areas.** See figure 4. Do Equipment Settings/Standardization/Setup (WP008 10), except as below:

a. Use two 57A2276 contact search units.

b. Use P-2 calibration point on 74D111295-1005 honeycomb reference standard.

19. **Inspection Procedure For Skin to Core Areas.** Do inspection of skin to core areas (WP008 10) and as below:

a. Use two 57A2276 contact search units.

b. Apply couplant to both surfaces of inspection area(s).

c. Make sure initial pulse width does not interfere with location of received response. If required, switch position of search units on microdot connecting cables, or use different search unit on receiver cable.

d. Use ultrasonic pulse-echo inspection (WP008 13) to determine if suspect areas are result of skin delaminations.

e. Do pulse-echo inspection on both mold line surfaces to help identify location of flaws causing through transmission unbond response. See figure 1 to identify skin thickness in marked area.

## WARNING

Dry cleaning solvent and methyl isobutyl ketone are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

**20. POST INSPECTION CLEANING AND CORROSION CONTROL.** After recording any defects, clean inspection marks and couplant from inspection areas with solvent moistened cloth.

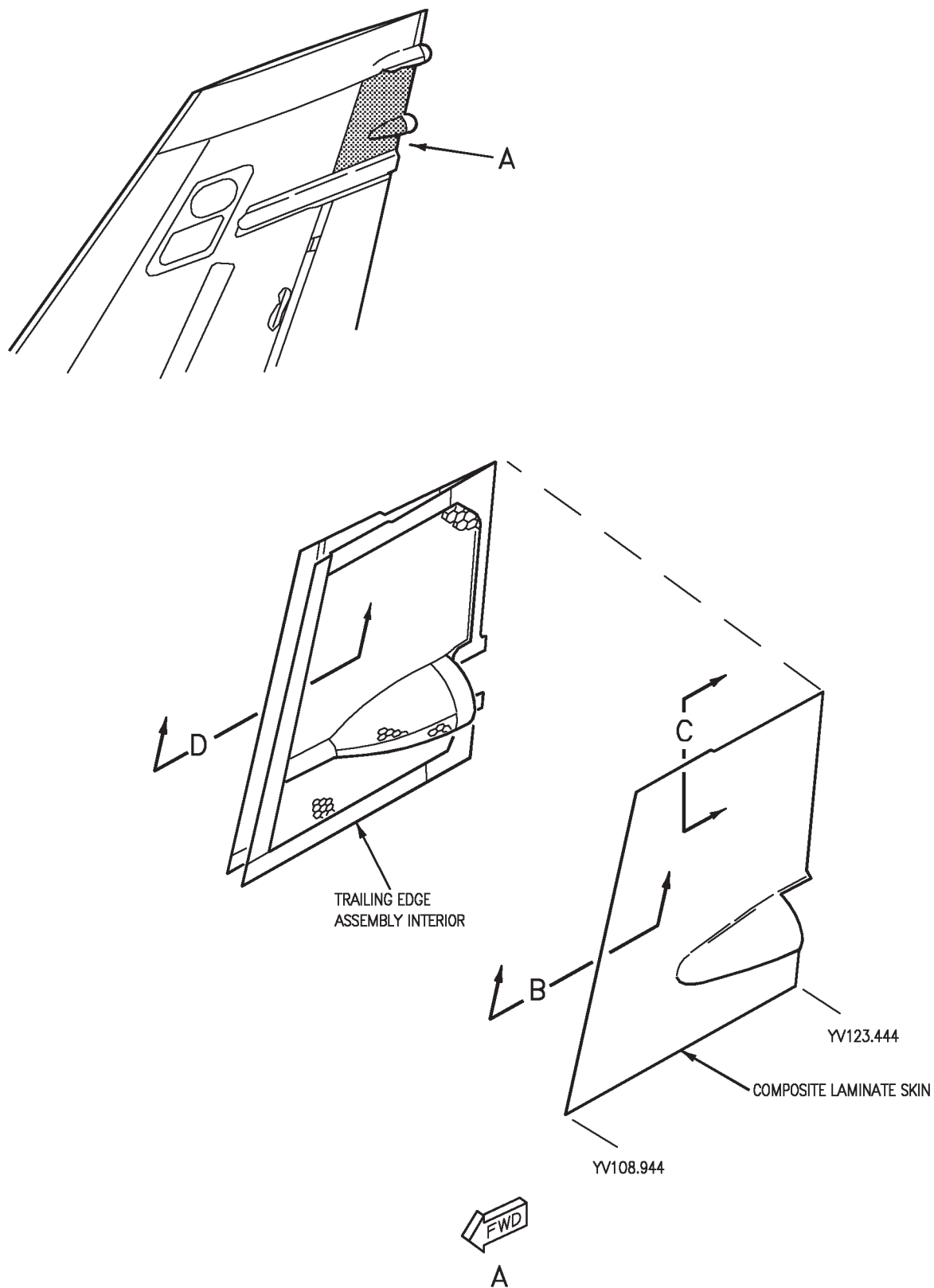
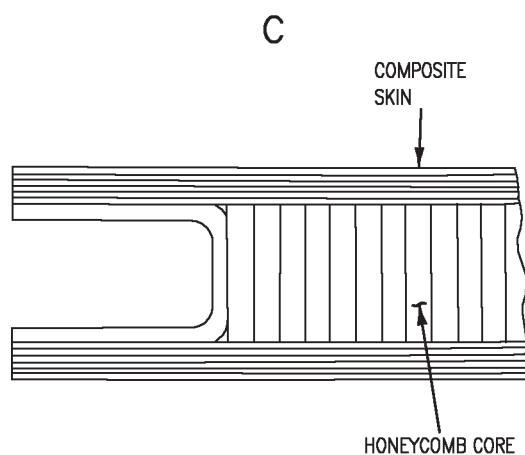
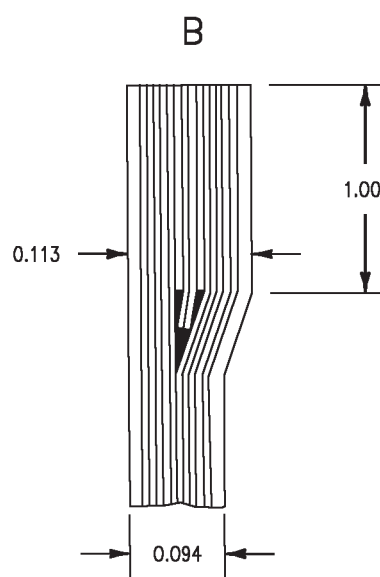
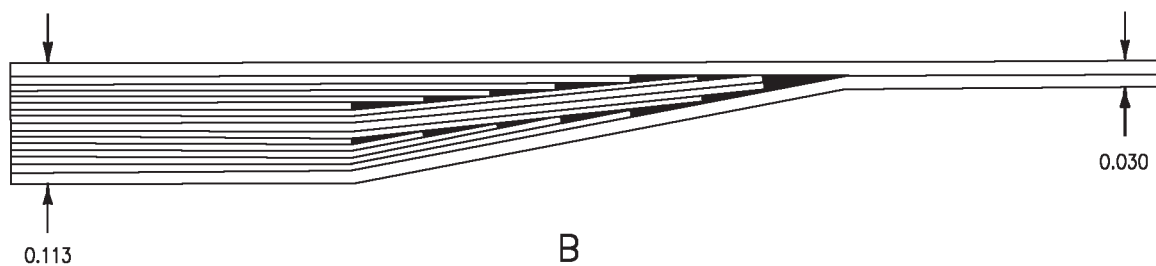


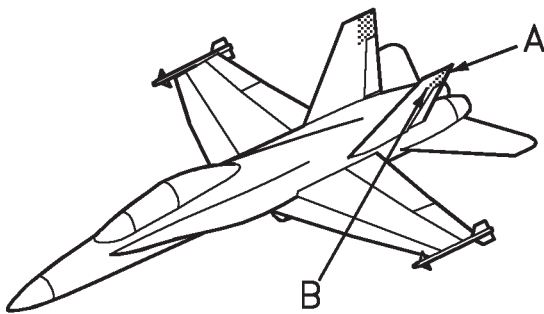
Figure 1. Trailing Edge Assembly (Sheet 1)



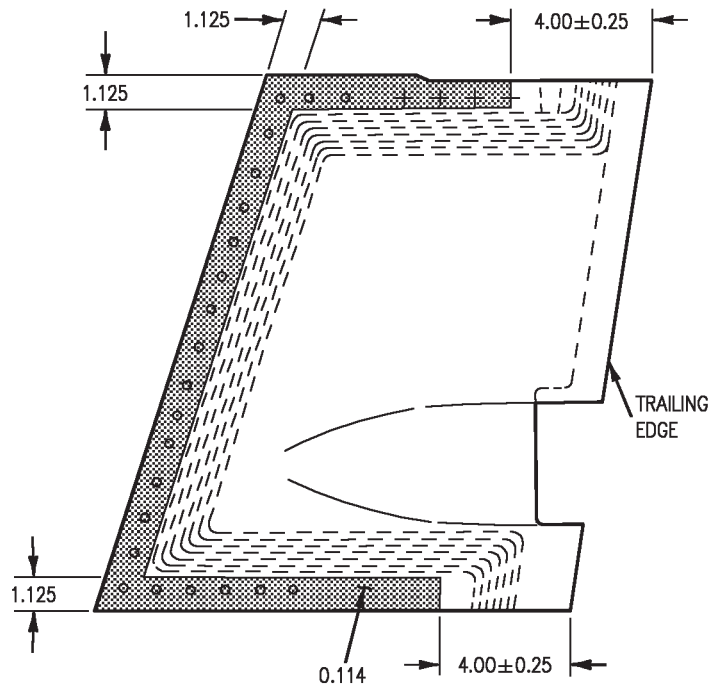


D

Figure 1. Trailing Edge Assembly (Sheet 2)

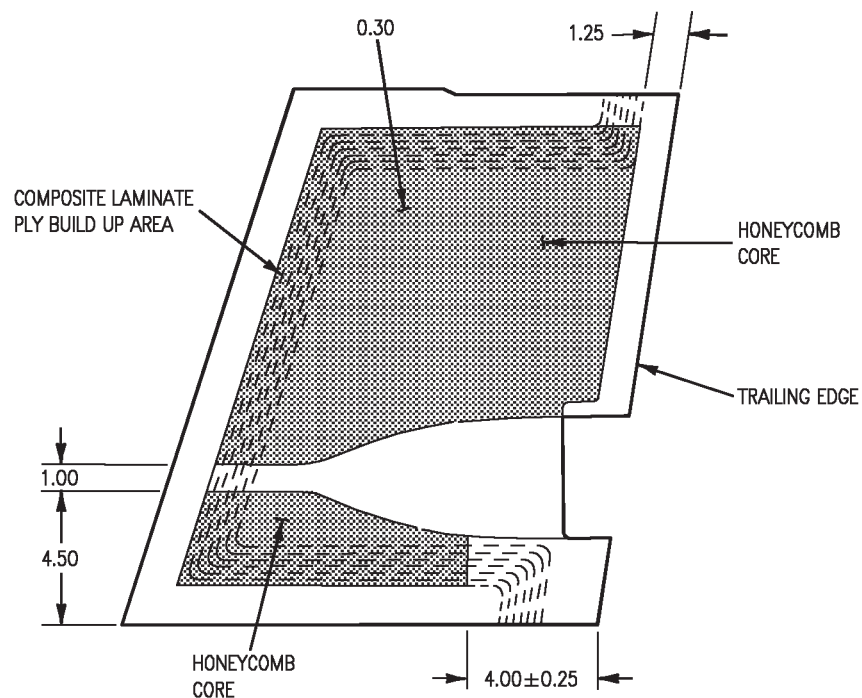


## LEGEND



LEFT SHOWN  
RIGHT OPPOSITE

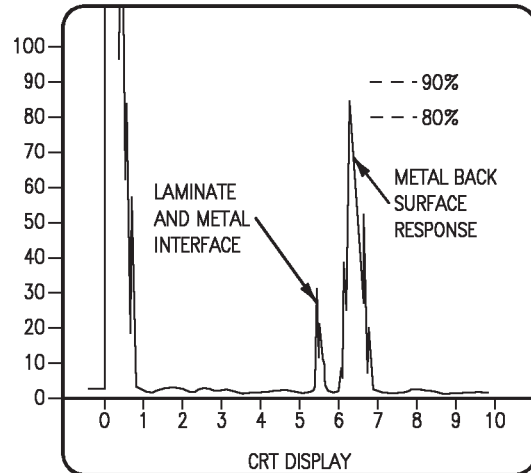
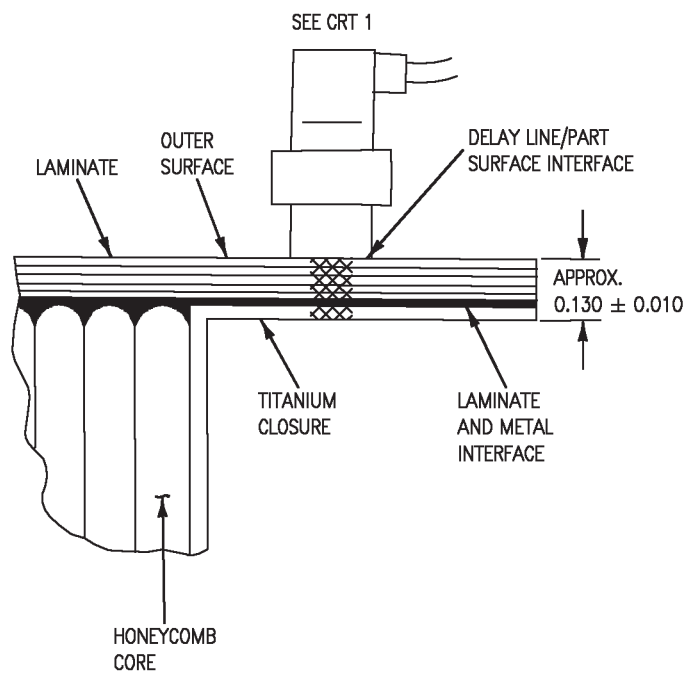
A



LEFT SHOWN  
RIGHT OPPOSITE

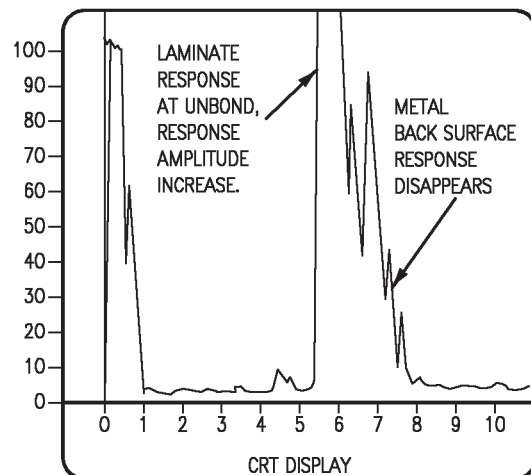
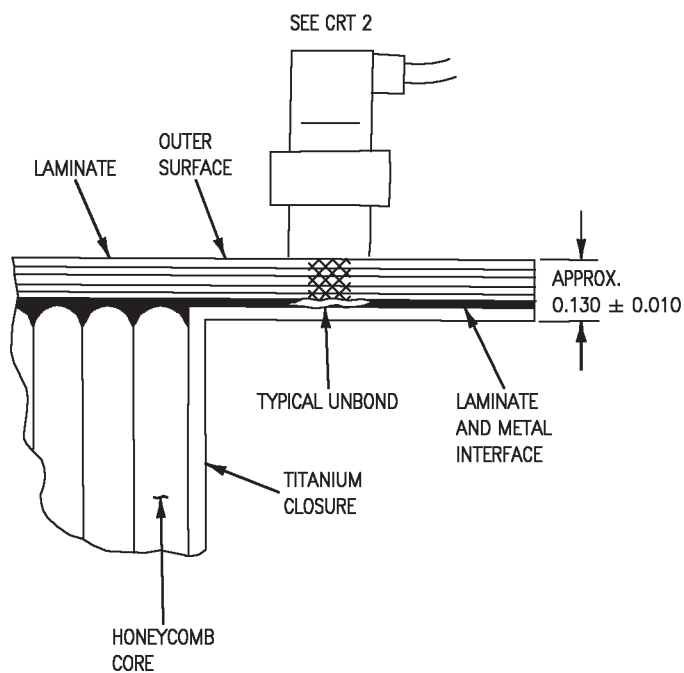
B

Figure 2. Inspection Areas



CRT 1

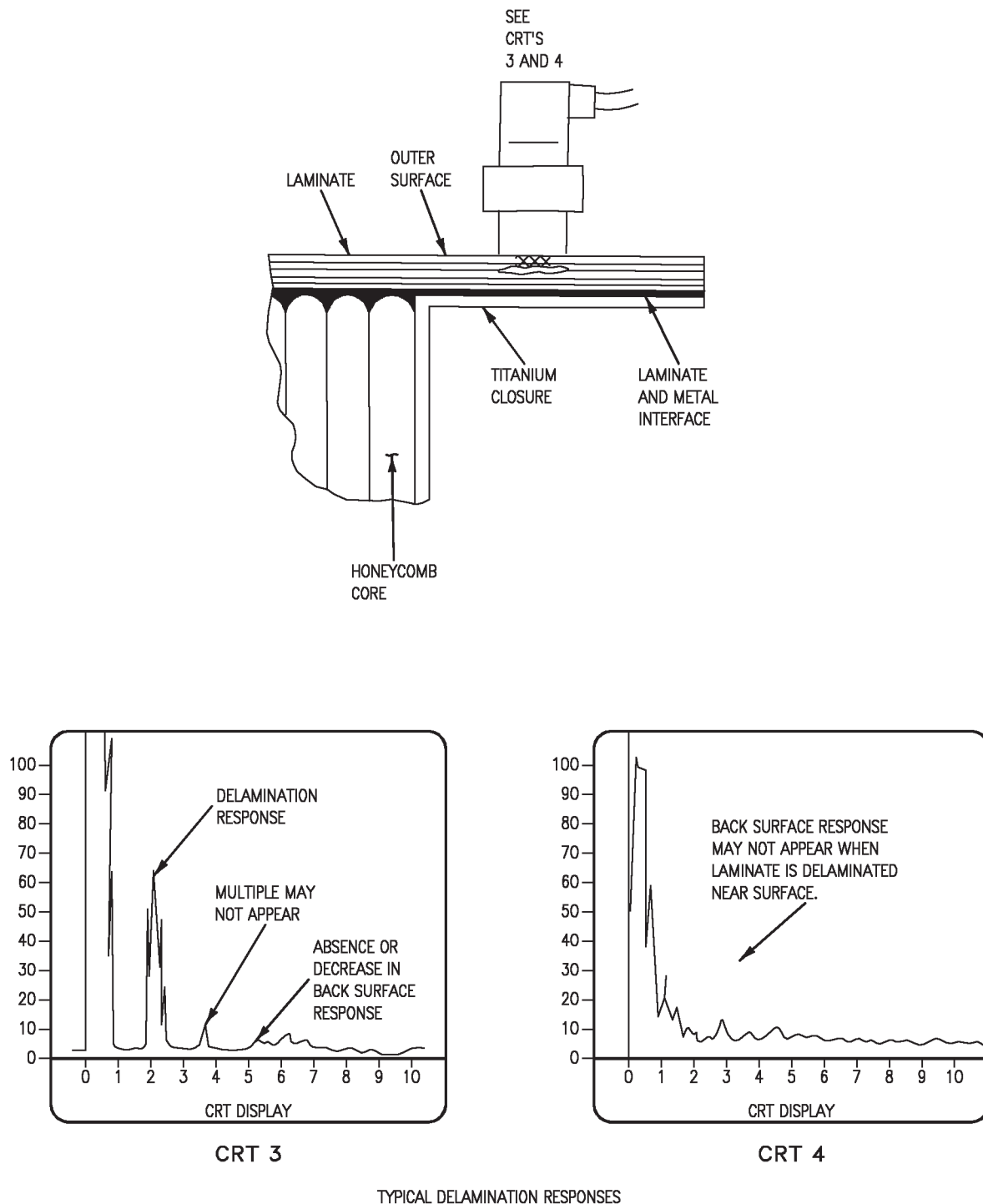
TYPICAL GOOD BOND RESPONSE

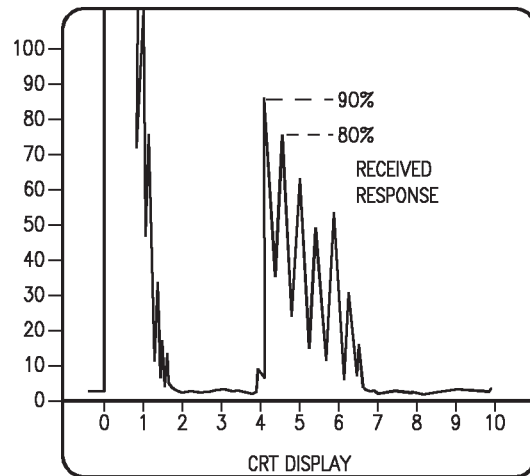
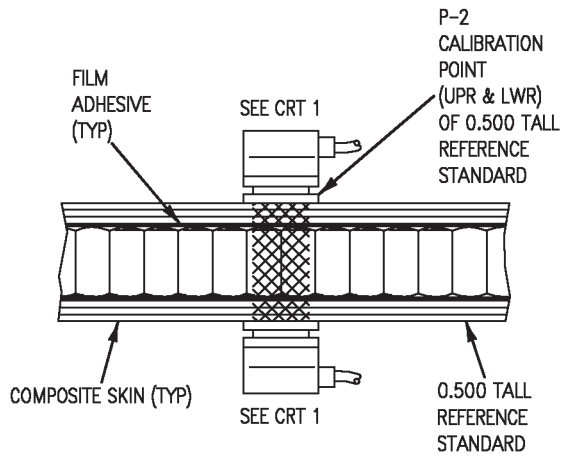


CRT 2

TYPICAL UNBOND RESPONSE

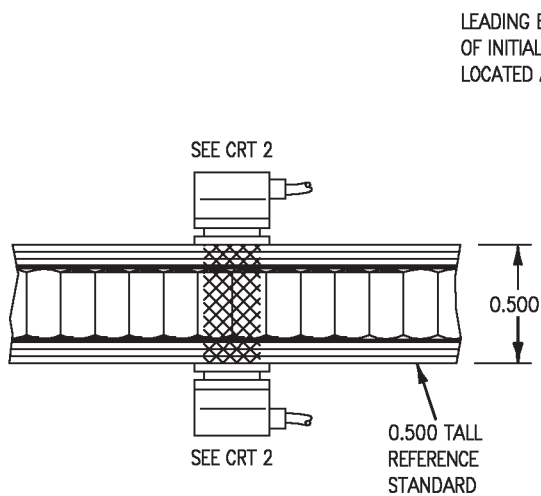
Figure 3. Composite Laminate Skin to Titanium Closure Inspection Responses (Sheet 1)



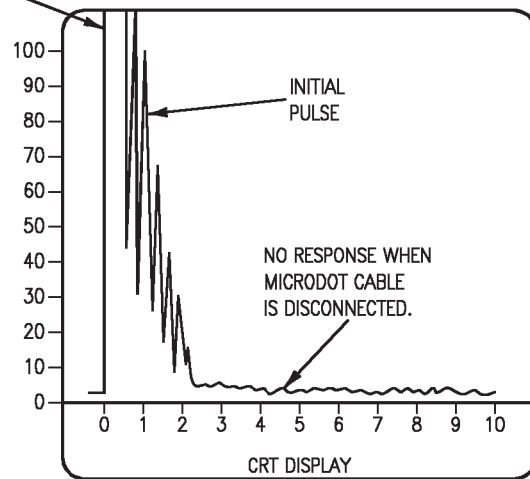


CRT 1

LEADING EDGE OF RECEIVED RESPONSE  
LOCATED AT 4 ON THE HORIZONTAL BASELINE.



LEADING EDGE  
OF INITIAL PULSE  
LOCATED AT ZERO.



CRT 2

Figure 4. Honeycomb Core and Setup Inspection Responses (Sheet 1)

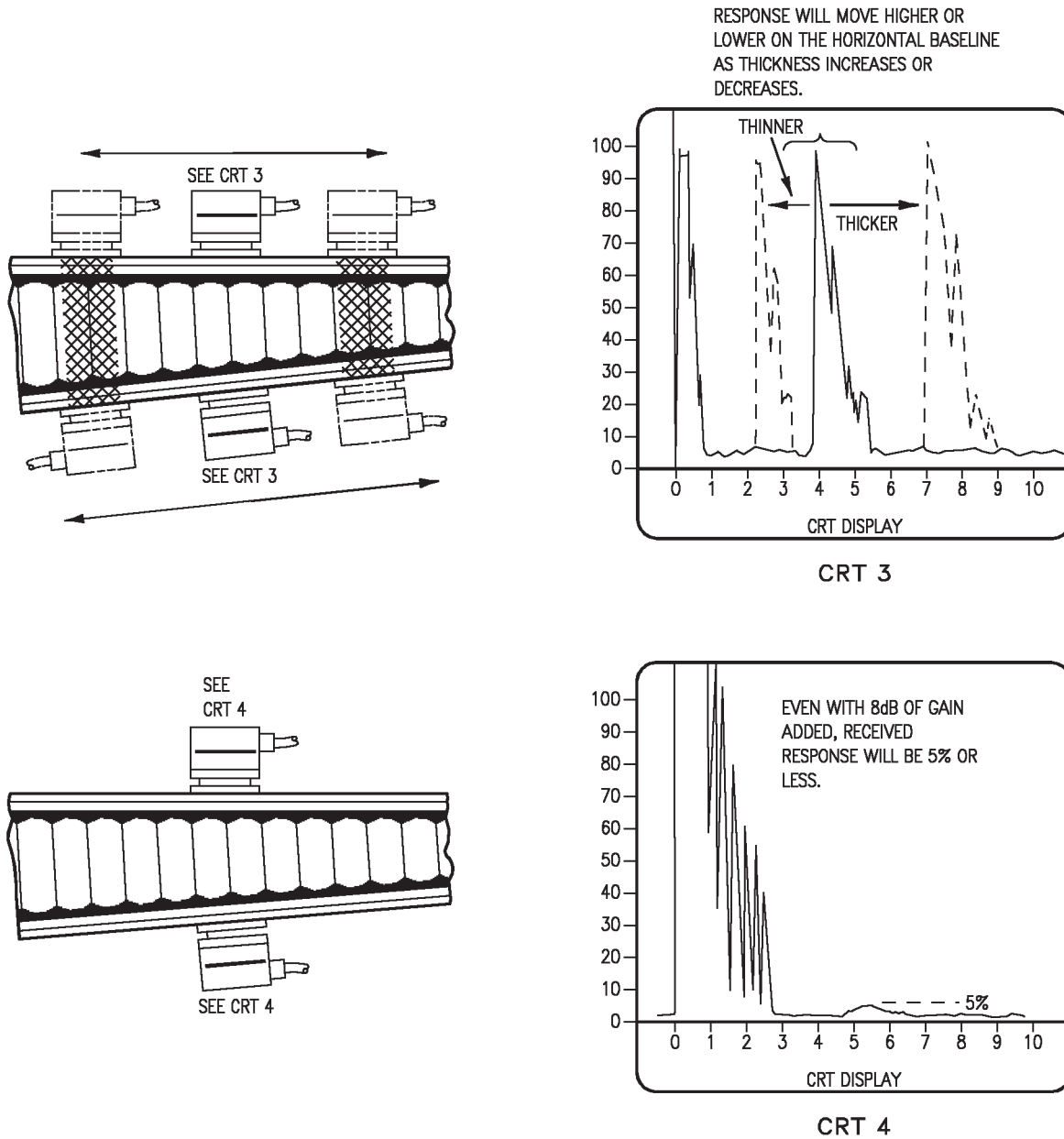


Figure 4. Honeycomb Core and Setup Inspection Responses (Sheet 2)

## INTERMEDIATE MAINTENANCE

## NONDESTRUCTIVE INSPECTION

## FORMERS AT Y590.500 AND Y598.000 FATIGUE CRACKS

## PART NO. 74A331316 AND 74A331321

This WP supersedes WP059 02, dated 15 December 1992.

## Reference Material

Naval Aviation Maintenance Program .....	OPNAVINST 4790.2
Line Maintenance Access Doors .....	A1-F18AC-LMM-010
Aircraft Corrosion Control.....	A1-F18AC-SRM-500
Stripping.....	WP007 00
Finish System .....	WP012 00
Nondestructive Inspection.....	A1-F18AC-SRM-300
Penetrant Method.....	WP004 00
Eddy Current Surface Inspection of Aluminum Alloys .....	WP007 00
Aircraft Weapons Systems Cleaning and Corrosion Control.....	NAVAIR 01-1A-509
Plane Captain Manual .....	A1-F18AC-PCM-000

## Alphabetical Index

Subject	Page No.
Formers at Y590.500 and Y598.000.....	1
Backup Inspection Method .....	2
Defects .....	1
Post Inspection Cleaning and Corrosion Control.....	4
Primary Inspection Method .....	1
System Securing.....	4

## Record of Applicable Technical Directives

None

## 1. FORMERS AT Y590.500 AND Y598.000.

2. Formers at Y590.500 and Y598.000 are tempered and machined from forged 7050 aluminum alloy, see figure 1. Former at Y590.500 has anodized coating and former at Y598.000 has ion vapor deposition (IVD), aluminum coating. Both have surface finish of epoxy primer and polyurethane coatings.

3. **DEFECTS.** Inspect inboard stub area of formers, for fatigue cracks. See figures 1 and 2.

4. **PRIMARY INSPECTION METHOD.** Primary inspection method is eddy current.

5. **Personnel Qualifications.** Personnel doing this nondestructive inspection should be qualified and certified to do eddy current inspections per

OPNAVINST 4790.2 SERIES, NDI Technicians,  
NEC 7225/MOS 6044.

6. **Preparation of Aircraft.** No special preparation required.

7. **Access.** Remove doors 86, 87, 88, and 89 (A1-F18AC-LMM-010).

### Support Equipment Required

Part Number or Type Designation	Nomenclature
ED520	Eddy Current Flaw Detector, Magnatest
S20204	EDM Notch Reference Standard, Aluminum
1RR90F-6-1/2	Right Angle Surface Probe, Ferrite Shielded

### Materials Required

Specification or Part Number	Nomenclature
020X413	Cleaning Compound
M83953-1 or -2	Pencil, Aircraft Marking
MILC87962TYPE1	Cloth, Cleaning

#### WARNING

Cleaning compound is flammable liquid and vapor. May cause allergic respiratory and skin reaction. May cause eye, skin and respiratory irritation. Keep away from heat, sparks, and flame. Do not breathe dust (vapor, mist, gas). Use only with adequate ventilation. Keep container closed. Avoid contact with eyes, skin and clothing. Wash thoroughly after handling.

8. **Preparation of Part.** Clean formers of any contamination or foreign material using cleaning cloth moistened with cleaning compound. Allow surface to air dry 15 minutes.

#### WARNING

Make sure safety precautions are met for electrical, static, grounding when using eddy current equipment near aircraft fuel cells, oxygen systems, electrical systems, electronic systems, and stores (A1-F18AC-PCM-000).

#### 9. Equipment Settings/Standardization/Setup.

Do ED520 Flaw Detector Setup (WP007 00) and set FUNC to MED using 0.020 X 0.040 EDM notch to get 150 microamperes needle deflection or 0.006 X 0.010 saw cut to get 200 microamperes needle deflection.

#### 10. Inspection Procedure.

Do Inspection Procedure (WP007 00) and steps below:

a. Scan perpendicular to suspected crack direction, see figure 2. Sharp down scale meter needle deflection exceeding 200 millamperes is indication of fatigue cracks.

b. Mark defects with aircraft marking pencil and record.

#### CAUTION

Penetrant inspection shall not be done, at suspect crack indication area, after abrasive material removal such as: grinding, sanding, or polishing. Smearing of material will result and interpretation of crack indication will not be possible.

#### NOTE

Penetrant inspection shall be used to verify original eddy current crack indication(s) only.

11. **BACKUP INSPECTION METHOD.** Backup inspection method is Fluorescent penetrant. Fluorescent penetrant may be used to verify indications detected by eddy current method.

12. **Personnel Qualifications.** Personnel doing this nondestructive inspection should be qualified and certified to do liquid penetrant inspections per OPNAVINST 4790.2 SERIES, NDI Technicians, NEC 7225/MOS 6044.



13. **Preparation of Aircraft.** No special preparation required.

- 14. **Access.** Same as primary method.



- Using abrasive material for paint removal will cause smearing of metal resulting in failure to detect crack(s) by penetrant method.

- 15. **Preparation of Part.** Remove finish system from inspection areas (A1-F18AC-SRM-500, WP007 00).

### Support Equipment Required

#### NOTE

Alternate item type designations or part numbers are listed in parentheses.

#### Part Number or Type Designation

#### Nomenclature

■ ZA43 (XMA101) (TT10)	Fluorescent Penetrant Inspection Kit, Portable
■ M-16 (ZB-26)	Black Light
■ —	Magnifier

### Materials Required

#### Specification or Part Number

#### Nomenclature

■ 020X413 M83953-1 or -2	Cleaning Compound Pencil, Aircraft Marking
MIL-C-85054 TY1	Corrosion Prevention Compound
CCC-C-440 TYPE 1 CLASS 1	Cheesecloth

16. **Inspection Procedure.** Do initial penetrant inspection.

a. Do type 1, method C fluorescent penetrant inspection (WP004 00) to detect fatigue cracks in areas shown in figure 1.

b. Remove excess penetrant by hand wiping.

(1) After penetrant dwell time is complete, remove excess penetrant by wiping with clean dry cheesecloth.

#### WARNING

Cleaning compound is flammable liquid and vapor. May cause allergic respiratory and skin reaction. May cause eye, skin and respiratory irritation. Keep away from heat, sparks, and flame. Do not breathe dust (vapor, mist, gas). Use only with adequate ventilation. Keep container closed. Avoid contact with eyes, skin and clothing. Wash thoroughly after handling.

#### NOTE

Remove fluorescent penetrant with aid of black light in shaded or darkened area.

(2) Remove background color or fluorescence from inspection areas using clean cheesecloth moistened with cleaning compound. Allow surface to air dry 15 minutes.

c. Spray thin film of developer on inspection areas.

d. Use black light and magnifier, if required, to view inspection areas for cracks.

e. Mark defect end points with sharp pointed aircraft marking pencil.

f. Record defects.

## 17. POST INSPECTION CLEANING AND CORROSION CONTROL.

### WARNING

Cleaning compound is flammable liquid and vapor. May cause allergic respiratory and skin reaction. May cause eye, skin and respiratory irritation. Keep away from heat, sparks, and flame. Do not breathe dust (vapor, mist, gas). Use only with adequate ventilation. Keep container closed. Avoid contact with eyes, skin and clothing. Wash thoroughly after handling.

a. Clean inspection material from inspection area using clean cheesecloth moistened with cleaning compound. Allow surface to air dry 15 minutes before application of finish system.

b. Restore finish system as below:

### WARNING

Corrosion prevention compound is flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

(1) Parts with confirmed cracks shall have unpainted surfaces coated with corrosion prevention compound (NAVAIR 01-1A-509).

(2) Parts having no defects, apply finish system (A1-F18AC-SRM-500, WP012 00).

18. **SYSTEM SECURING.** Install doors 86, 87, 88, and 89 (A1-F18AC-LMM-010).

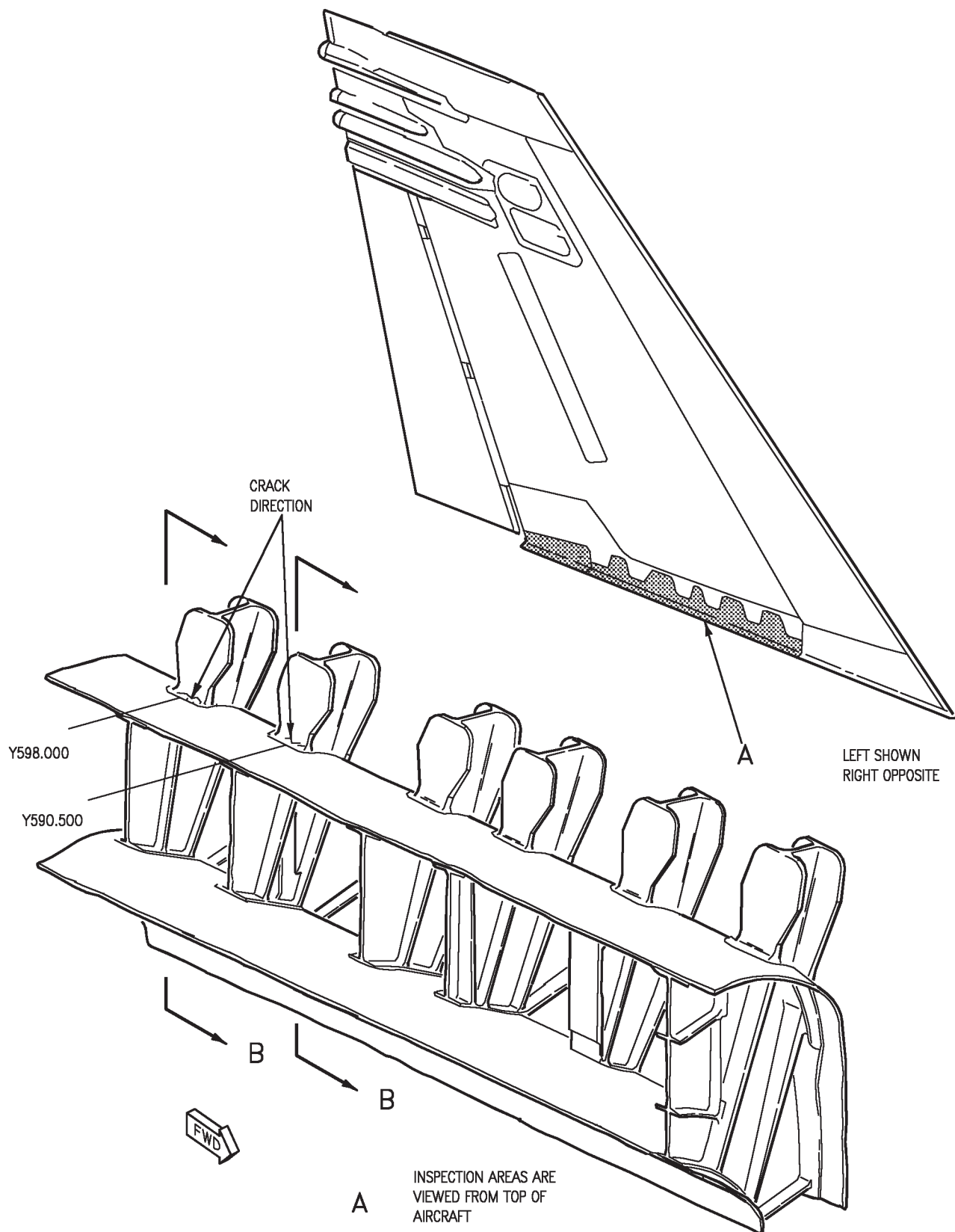


Figure 1. Location of Formers and Inspection Areas (Sheet 1)

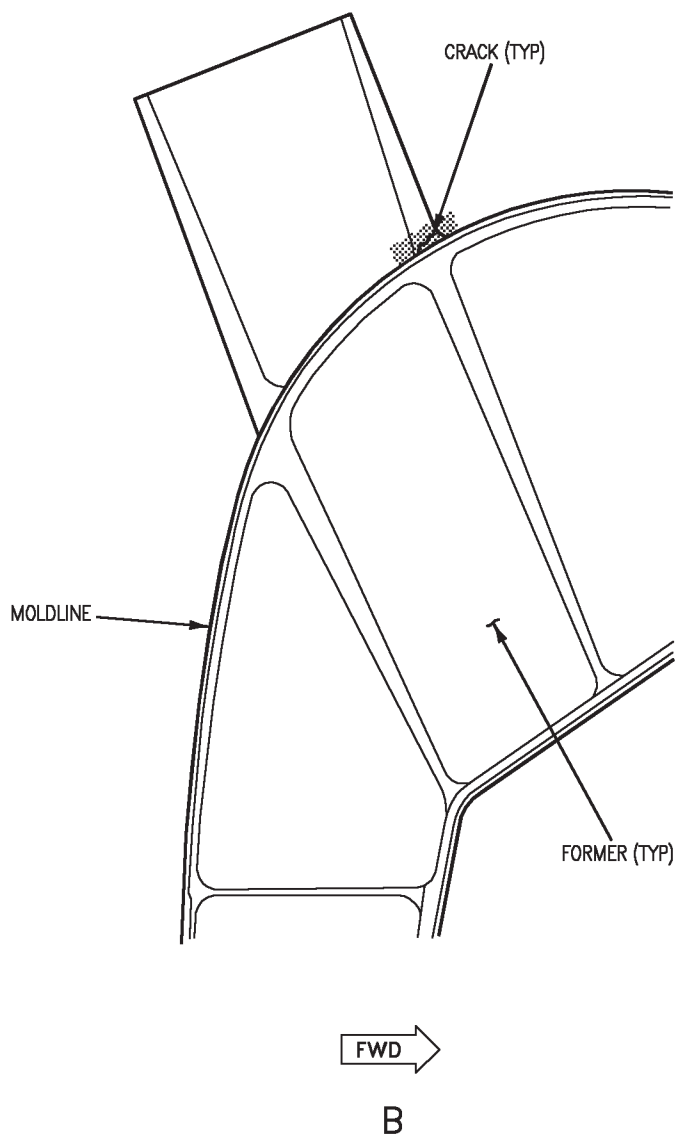
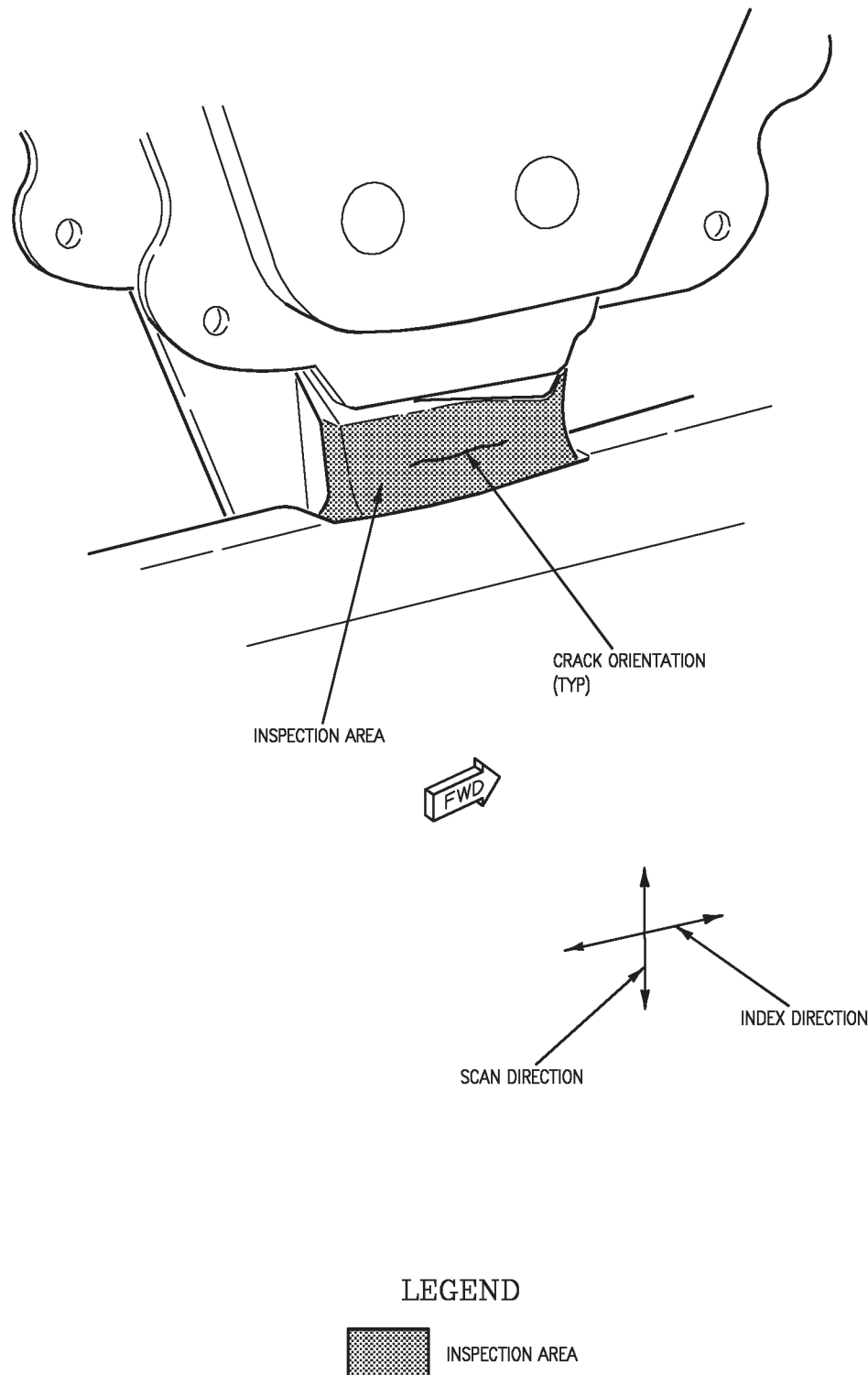


Figure 1. Location of Formers and Inspection Areas (Sheet 2)



**Figure 2. Index Direction, Scan Direction, and Crack Orientation**



## INTERMEDIATE MAINTENANCE

## NONDESTRUCTIVE INSPECTION

FORMERS AT Y590.500 AND Y598.000, IN STIFFENER AREA,  
FATIGUE CRACKS

PART NO. 74A331316 AND 74A331321

EFFECTIVITY: 161353 THRU 163510

This WP supersedes WP059 03, dated 15 December 1992.

## Reference Material

Naval Aviation Maintenance Program ..... OPNAVINST 4790.2  
Line Maintenance Access Doors ..... A1-F18AC-LMM-010  
Plane Captain Manual ..... A1-F18AC-PCM-000

## Alphabetical Index

Subject	Page No.
Formers at Y590.500 and Y598.000 .....	1
Defects .....	1
Primary Inspection Method .....	1
Post Inspection Cleaning and Corrosion Control .....	4
System Securing .....	4

## Record of Applicable Technical Directives

Type/ Number	Date	Title and ECP No.	Date Incorp.	Remarks
F/A-18 AFB 171	Mar 89	Inspection of Y598.0 and Y590.5 Formers	15 Feb 94	No ECP

## 1. FORMERS AT Y590.500 AND Y598.000.

See figure 1.

2. Formers at Y590.500 and Y598.000, P/N's 74A331321 and 74A331316, are machined from 7050 aluminum die forgings and tempered to T73651 condition. Finish system is;

- Anodize/one coats primer
- Anodize/two coats primer
- IVD/two coats primer

3. DEFECTS. Inspect formers below stiffener for fatigue cracks.

4. PRIMARY INSPECTION METHOD. The primary inspection method is eddy current.

5. Personnel Qualifications. Personnel doing this nondestructive inspection should be qualified and certified to do eddy current inspections per OPNAVINST 4790.2 SERIES, NDI Technicians, NEC 7225/MOS 6044.

6. **Preparation of Aircraft.** No special preparation required.

7. **Access.** Have doors 67 L/R and 75 L/R removed (A1-F18AC-LMM-010).

## NOTE

Any impedance plane eddy current equipment may be used for this procedure in conjunction with any probe, if equipment and probe are standardized in method similar to paragraph 8. In addition, alternate probes may be used with NDT-25N if they are standardized identical to paragraph 8. Exact settings may vary.

Reference standard is considered equivalent, for surface inspections, if made of same base alloy as part to be inspected and contains an Electrical Discharge Machined (EDM) notch between 0.006 and 0.020 deep, machined in surface of standard.

## Support Equipment Required (Continued)

Part Number or Type Designation	Nomenclature
MP905-50	Probe, Ferrite Shielded, 1/8 Inch Dia., 1/2 Inch Drop, 90 De- gree, 200 kHz., 5 Inches long , Micro- dot Connector.
TPF902	Probe, Ferrite Shielded, 1/8 Inch Dia., 0.2 Inch Drop, 90 De- gree, 200 kHz., 5 Inches long , Micro- dot Connector.
ADN-B1	Adapter, Probe, Dual BCN to 12 Pin Burndy,
NRK-3AL or EQUIVALENT	Aluminum Eddy Cur- rent Reference Stan- dard

## Support Equipment Required

## NOTE

Alternate item type designations or part numbers are listed in parentheses.

Part Number or Type Designation	Nomenclature
NDT-25N, MXU-713/E 9505955	Programmable Eddyscope, Nortec NDT-25N Accessory Kit, Nortec
57A2271 (187100)	Microdot to BNC Connecting Cable, 2 Reqd.
GPK-36 MP457-50C	Navy Probe Kit Probe, Ferrite Shielded, 1/8 Inch Dia., 0.7 Inch Drop, 45 De- gree, 200 kHz., 5 Inches long , Micro- dot Connector

## Materials Required

## NOTE

Alternate item specifications or part numbers are shown indented.

Specification or Part Number	Nomenclature
GENERIC	Any cleaning solvent locally approved for use on F/A-18 and acceptable per local environmental regu- lations.
CCC-C-46, TYPE 1 CLASS 4	Cleaning Cloth
MIL-P-83953-2, TYPE 1 CLASS A or B, BLACK or RED	Aircraft Marking Pencil



**WARNING**

Make sure safety precautions are met for electrical, static, grounding when using eddy current equipment near aircraft fuel cells, oxygen systems, electrical systems, electronics systems, and stores (A1-F18AC-PCM-000).

**8. Equipment Settings/Standardization/Setup.**

- a. Connect ADN-81, BNC Adapter, part of 9505955 accessory kit, to NDT-25N programmable eddyscope (TESTER).
- b. Connect two connecting cables to adapter.
- c. Connect probe being used for inspection to cable connected to front of adapter and second probe, approximately same frequency and coil size, to cable connected to side of adapter. Probe connected to side of adapter is used for reference coil and must be kept away from electrically conductive material.
- d. Settings are entered by first pressing button of desired function, existing setting will then be given on digital display. Existing settings may be changed by pressing up or down directional buttons, indicated by triangular arrow, or by entering in desired setting value on key pad, then press ENTER. Initial settings should be as follows;

POWER.....	ON
STATUS LIGHTS .....	ON
GAIN .....	30
FREQ.....	200
FILTER.....	0
HORN .....	OFF
H SENS.....	0.5
VSNS .....	0.2
DISPLAY .....	H/V
I/O SWITCHES.....	OFF
ALARM.....	OFF
NON-STORE .....	OFF

- e. Position probe on reference standard as shown in figure 2, away from any engraving, notch, hole, or edge.

- f. Press NULL button and press ERASE button.

- g. Press POS button and press directional buttons, as indicated by triangular arrow on button, until dot is centered on CRT.

- h. Press NULL button and ERASE button in succession, see figure 3, CRT 1.

**NOTE**

On succeeding operations, press ERASE button, as required.

- i. Adjust ANGLE, as required, to get trace on CRT similar to that shown on figure 3, CRT 2 as probe is lifted off surface of reference standard. Press NULL after each ANGLE adjustment is entered into unit.

- j. Scan probe over EDM surface notches and toward edge of reference standard to show edge effect. Maintain constant distance of 1/8 to 1/4 inch from edge of reference standard. Traces should appear on CRT similar to those shown on on figure 3, CRT 3. If traces are not similar adjust GAIN and ANGLE until traces are similar. Press NULL after any change(s) to GAIN.

**9. Inspection Procedure.**

- a. Visually inspect surfaces of former(s) shown in figure 1 for cracks using flashlight and mirror. Areas that are cracked may show accumulation of dirt or soot.

**WARNING**

Cleaning solvent may be flammable and toxic to eyes, skin and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas.

- b. Clean inspection area(s) with solvent moistened cloth to make sure inspection area(s) is free of contamination or foreign material.

- c. Position probe on surface to be inspected, see figure 1.

- d. Press NULL button and ERASE button, CRT should be as shown in figure 4, CRT 1.

- e. Lift probe off inspection area to determine lift-off direction.

f. Adjust ANGLE, as required, to make lift-off travel from center of CRT, to left, as shown in figure 4. CRT 2.

g. Index 1/16-inch between scans. Traces similar to those shown in figure 4, CRT 3, should result.

### NOTE

Lift-off will always make traces to left. Tapered section that is becoming thinner during scanning will make downward trace on CRT. Rocking probe will make trace in lift-off direction and in direction 180 degrees opposite lift-off.

h. Press NULL and ERASE, as required, to keep CRT display similar to those shown in figure 4, CRT 3 during scanning. It is acceptable for dot on CRT to travel along lift-off line as long as it remains on CRT. Rescan any area in which cursor has left CRT. Be careful to maintain good contact between probe tip and part, and minimizing rocking of probe.

i. Any traces appearing on CRT having separation angle from lift-off greater than smallest notch depth on reference standard, shall be marked on part with aircraft marking pencil, provided indication is repeatable, see figure 3, CRT 3.

### NOTE

Due to variation in conductivity from part-to-part or reference standard-to-reference standard, trace direction may rotate slightly. Less conductive parts, other than reference standard, will have traces rotated counter clockwise. More conductive parts will have traces rotated slightly clockwise from those traces shown in figures 3 and 4.

j. Determine crack length by scanning back and forth perpendicular to crack while indexing along crack centerline.

k. When determining crack length, ends of cracks will be determined when dot returns to center position on CRT. To verify end of crack scan from good area into suspected end of crack. Mark area on part where dot begins to raise from centerline.

10. **Documentation.** See figure 5.

a. If cracks are found, map location and provide dimensions on illustration similar to figure 5. Include information such as Aircraft Bureau Number, total flight hours, Airframe Bulletin No., date of inspection, and printed name of inspector. File one copy of this document in aircraft maintenance log and provide second copy to local MCAIR Representative.

b. Engineering disposition required for all crack indications.

### WARNING

Cleaning solvent may be flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas.

11. **POST INSPECTION CLEANING AND CORROSION CONTROL.** Clean inspection area with solvent moistened cloth to remove inspection marks or foreign material.

12. **SYSTEM SECURING.** Have doors 67 L/R and 75 L/R installed (A1-F18AC-LMM-010).

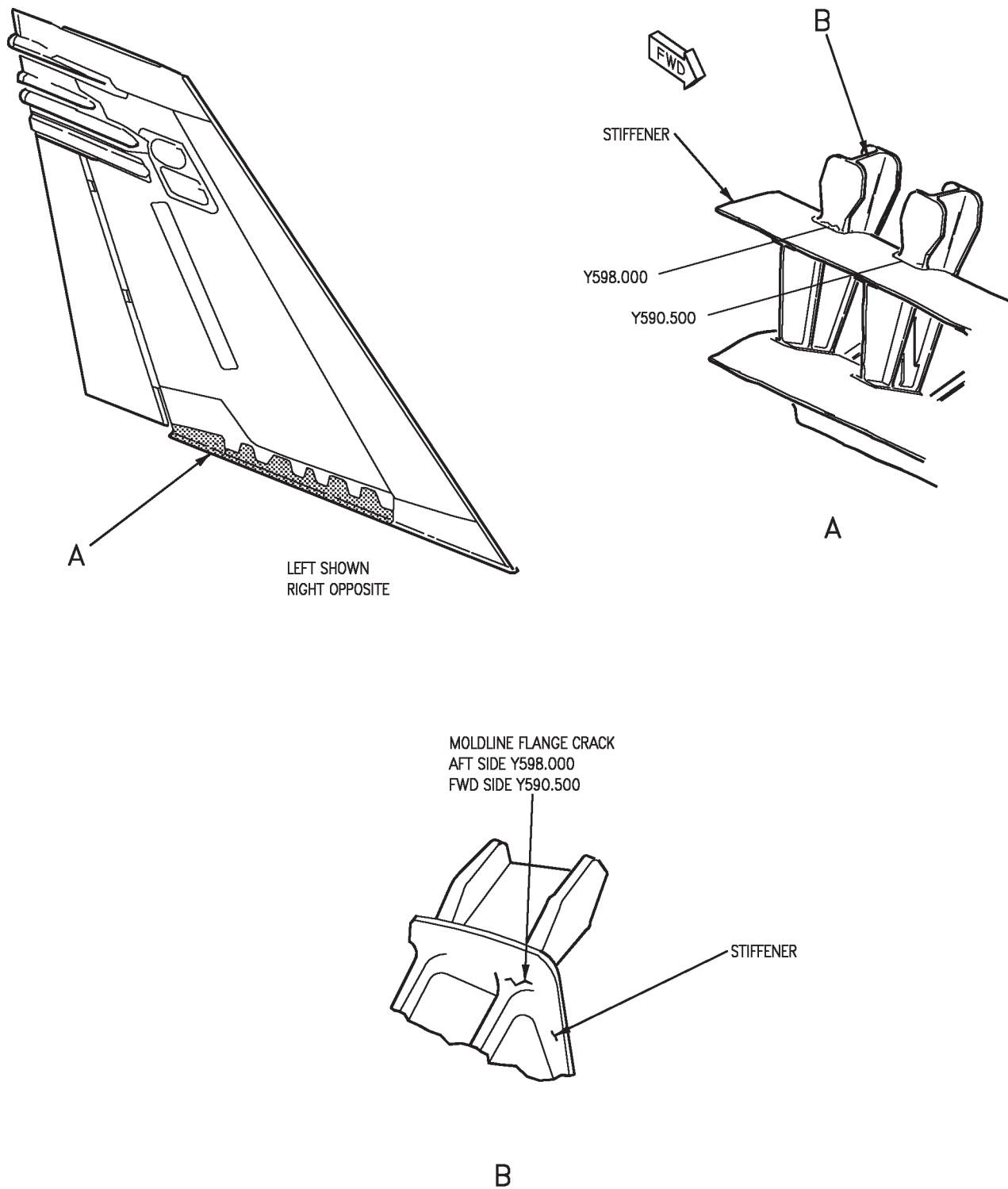
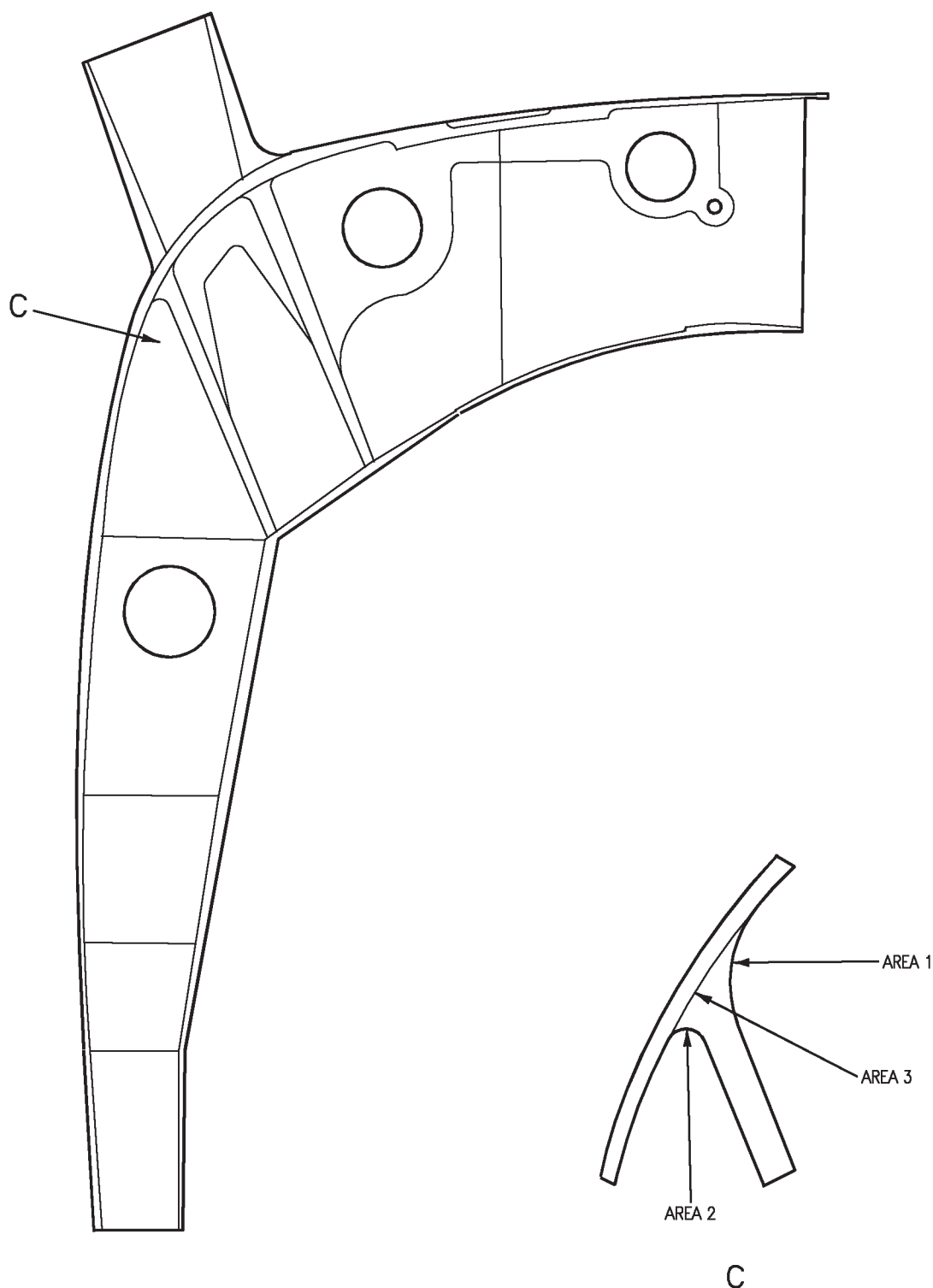
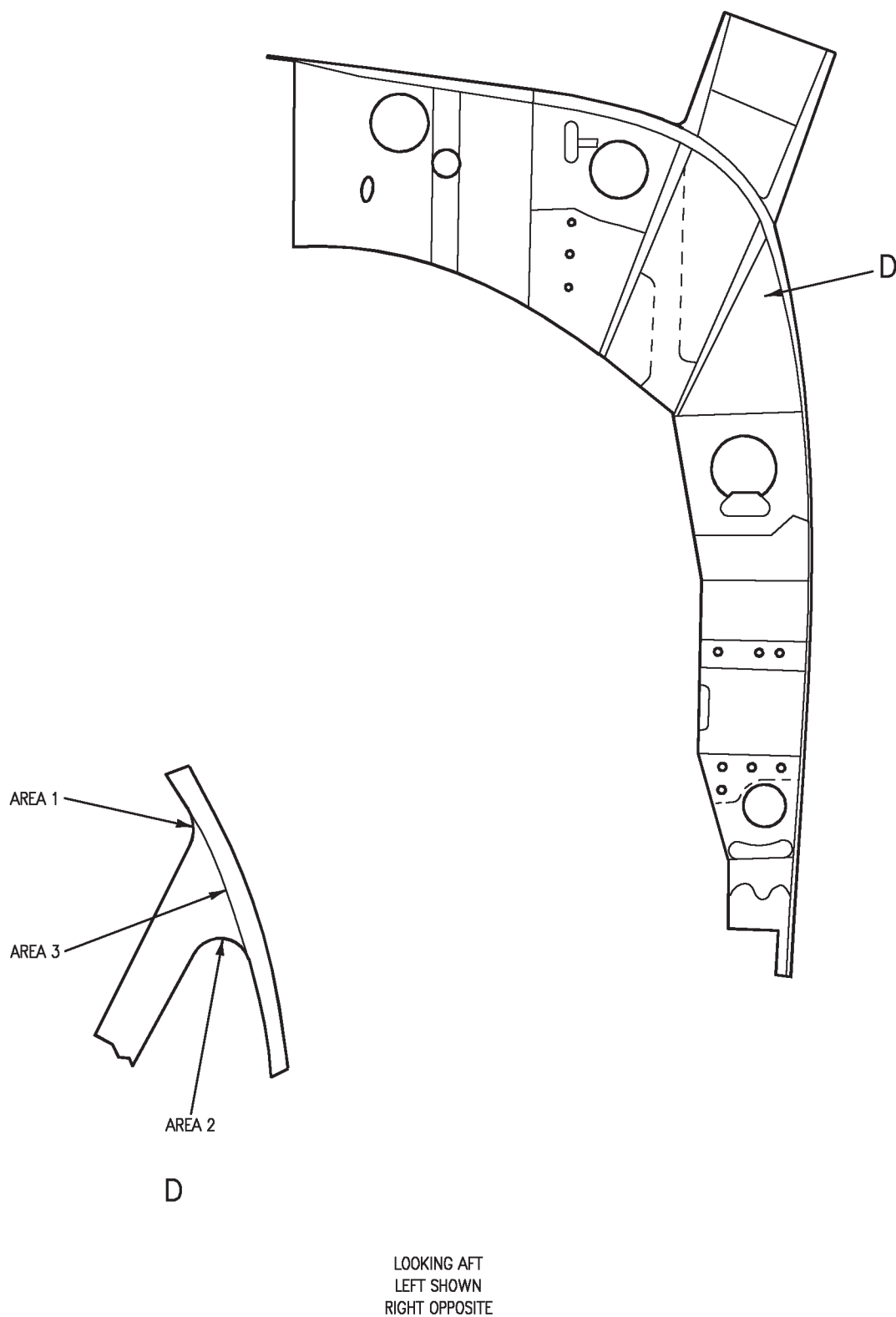


Figure 1. Inspection Areas of Y598.0 and Y590.5 Formers (Sheet 1)



LOOKING FORWARD  
LEFT SHOWN  
RIGHT OPPOSITE

**Figure 1. Inspection Areas of Y598.0 and Y590.5 Formers (Sheet 2)**



**Figure 1. Inspection Areas of Y598.0 and Y590.5 Formers (Sheet 3)**

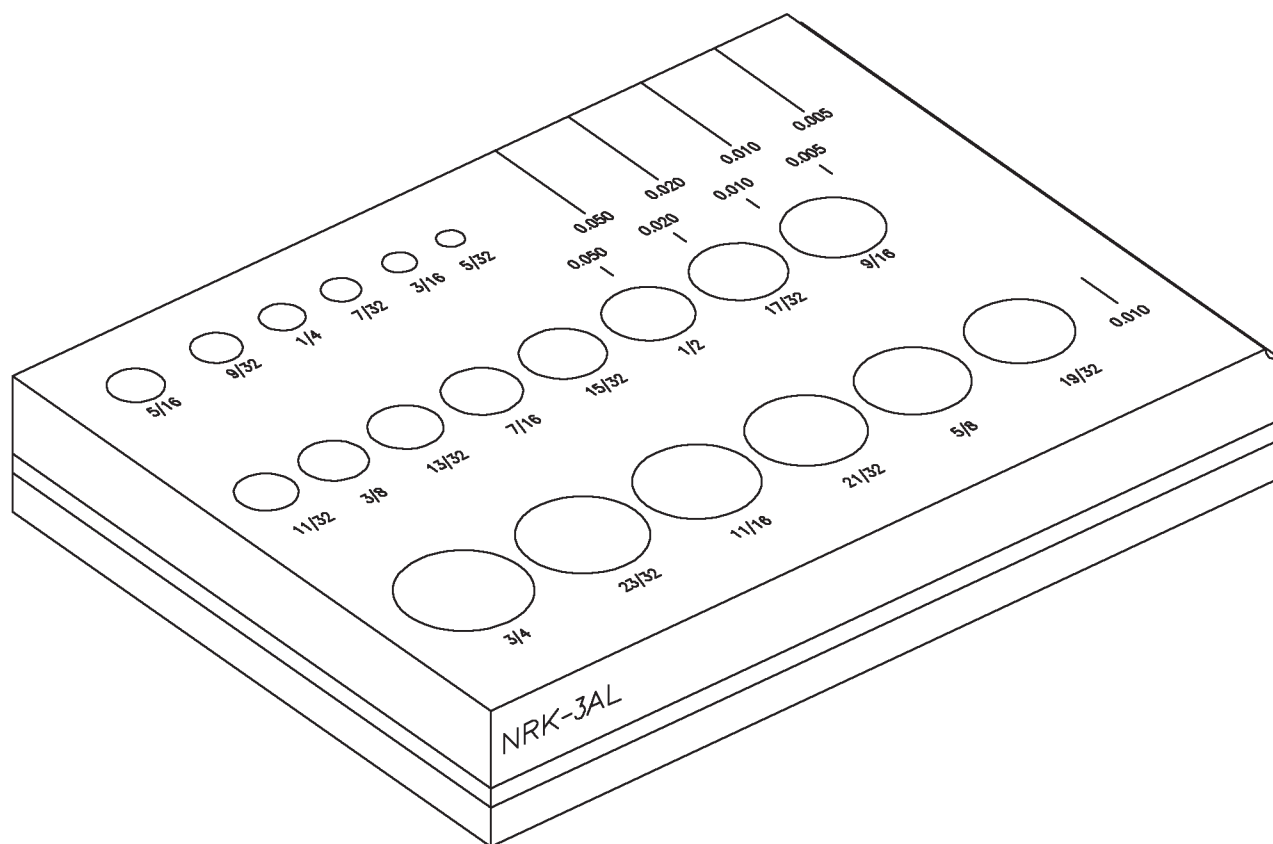
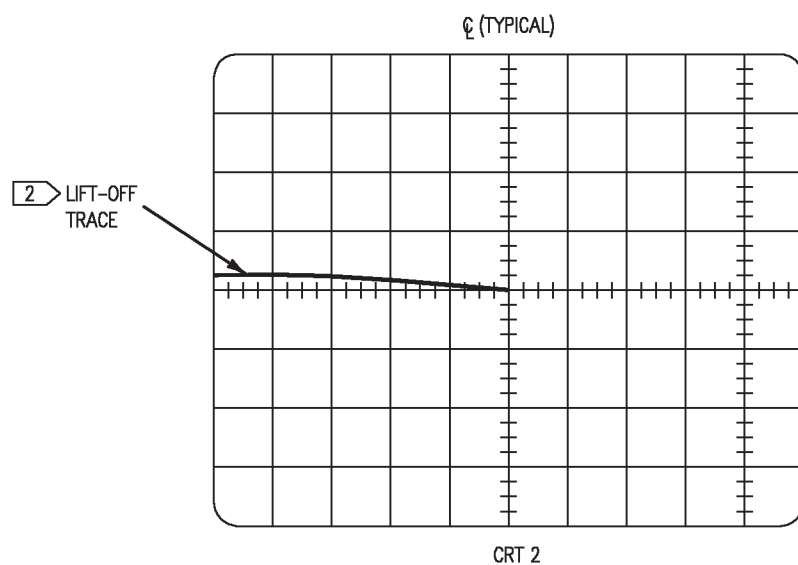
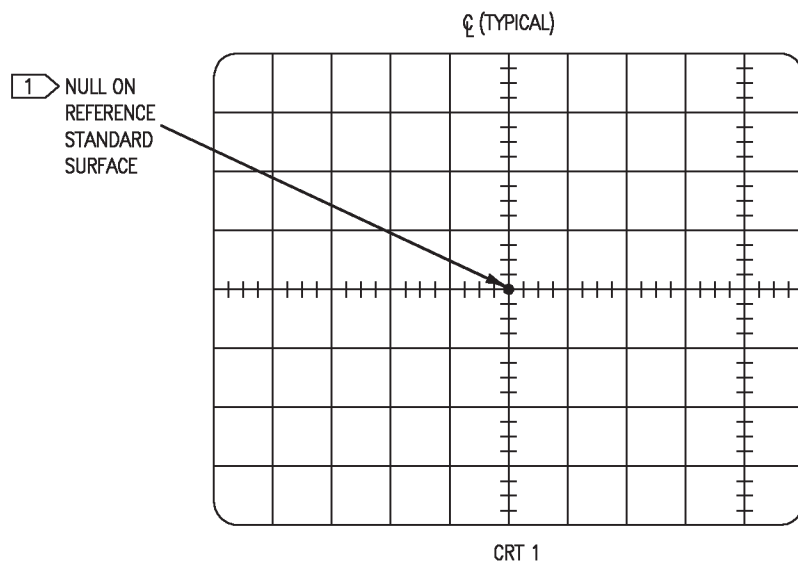
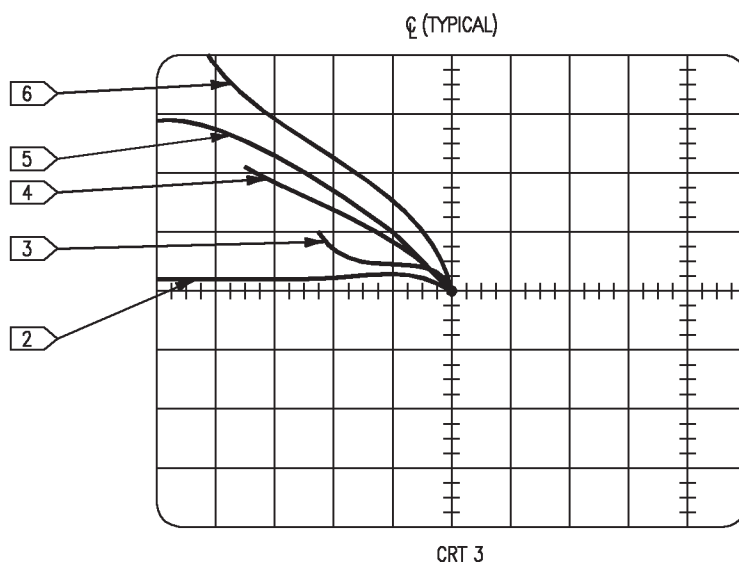


Figure 2. NRK-3AL Reference Standard



**Figure 3. CRT Displays from Standardization of NDT-25N (Sheet 1)**

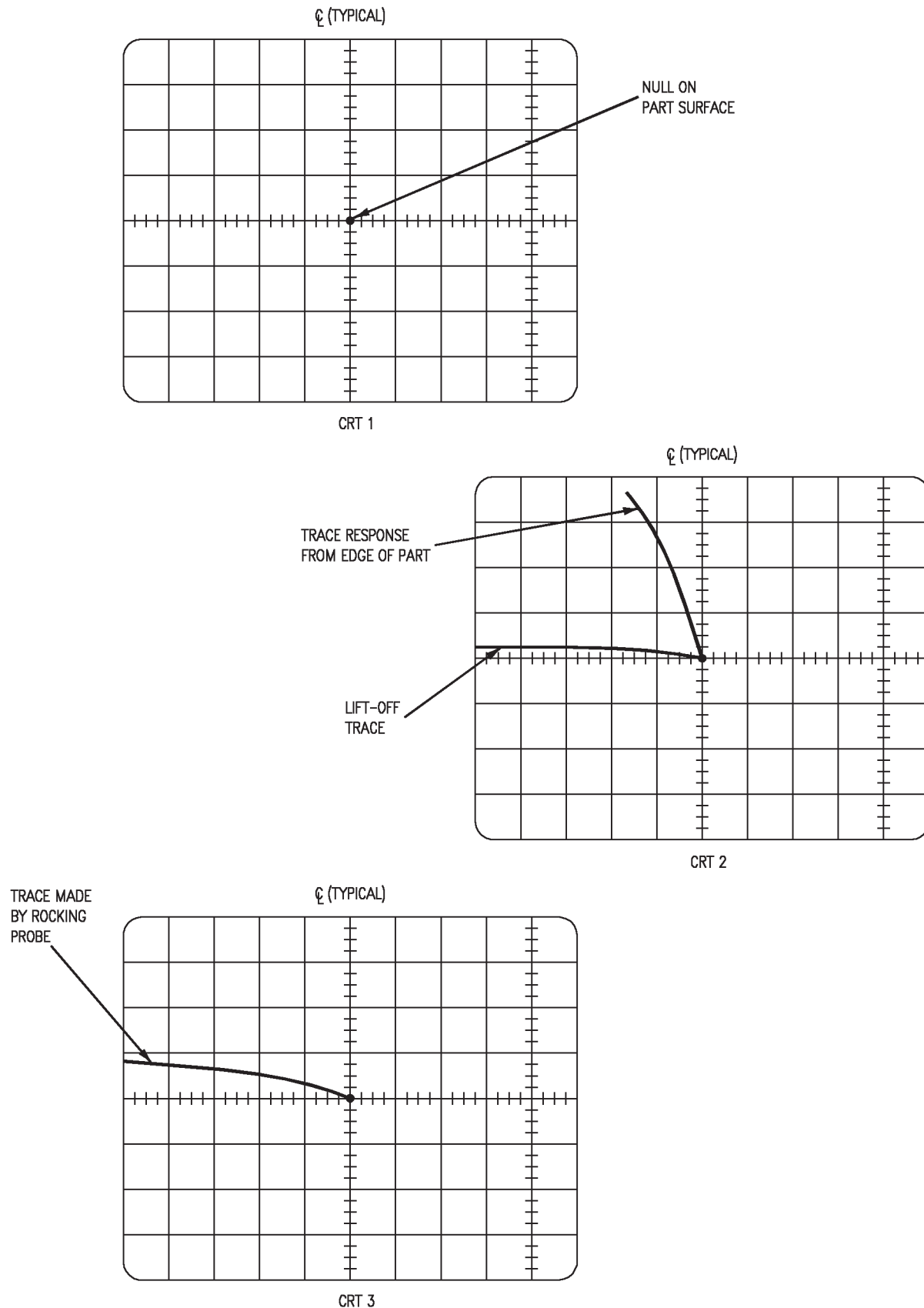


### LEGEND

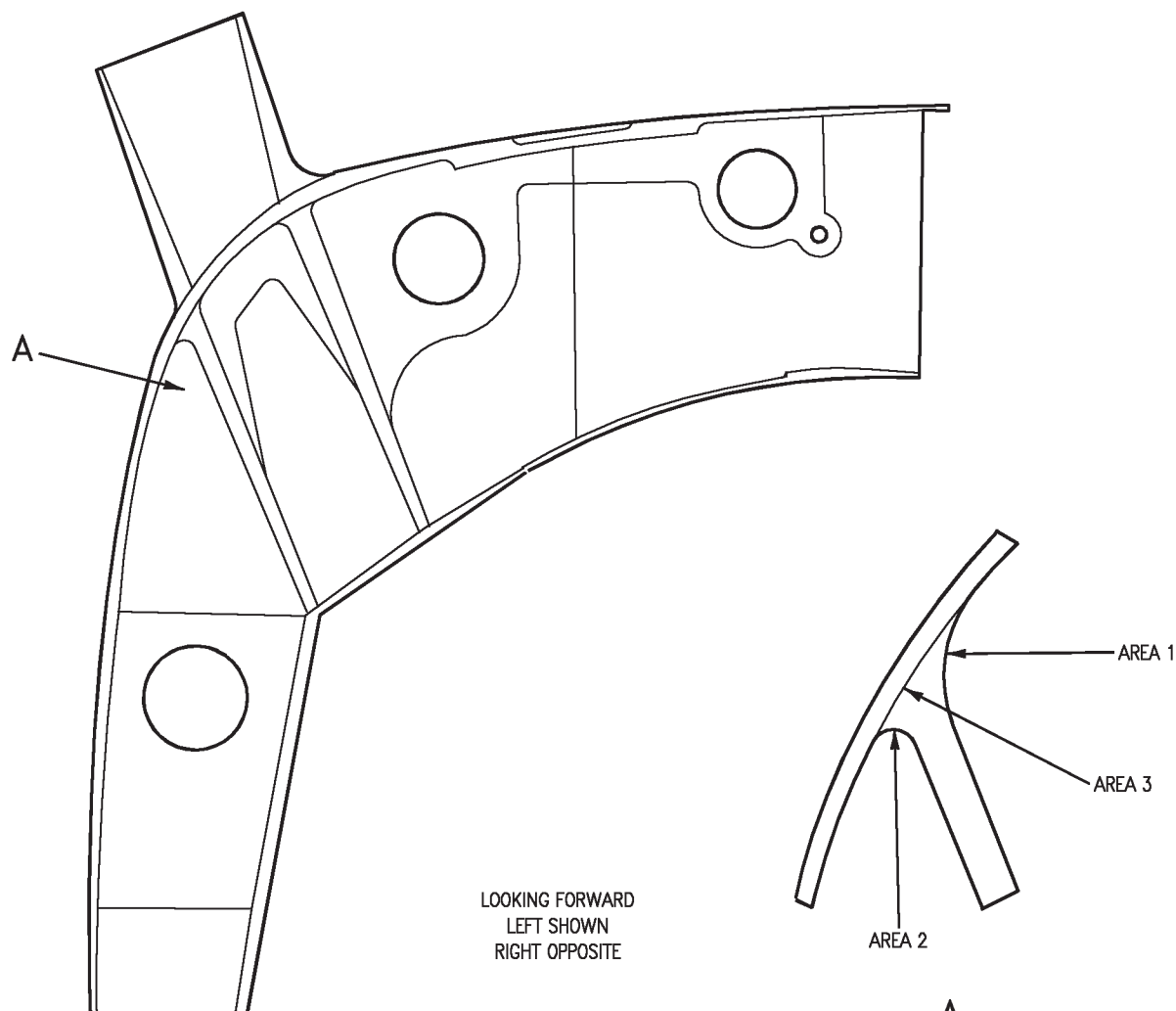
- 1 POSITION PROBE AWAY FROM EDGE OR NOTCH, NORMAL TO REFERENCE STANDARD SURFACE. PRESS POS BUTTON AND THEN PRESS DIRECTIONAL BUTTONS, INDICATED BY TRIANGULAR ARROW ON BUTTON, UNTIL DOT IS IN CENTER OF CRT. PRESS NULL BUTTON. PRESS ERASE BUTTON.
- 2 LIFT-OFF TRACE RESPONSE WHEN PROBE IS REMOVED FROM REFERENCE STANDARD.
- 3 TRACE RESPONSE FROM 0.010 NOTCH.
- 4 TRACE RESPONSE FROM 0.020 NOTCH.
- 5 TRACE RESPONSE FROM 0.050 NOTCH.
- 6 TRACE RESPONSE FROM EDGE OF REFERENCE STANDARD.

Figure 3. CRT Displays from Standardization of NDT-25N (Sheet 2)





**Figure 4. CRT Displays From Inspection of Aluminum Outboard Formers**



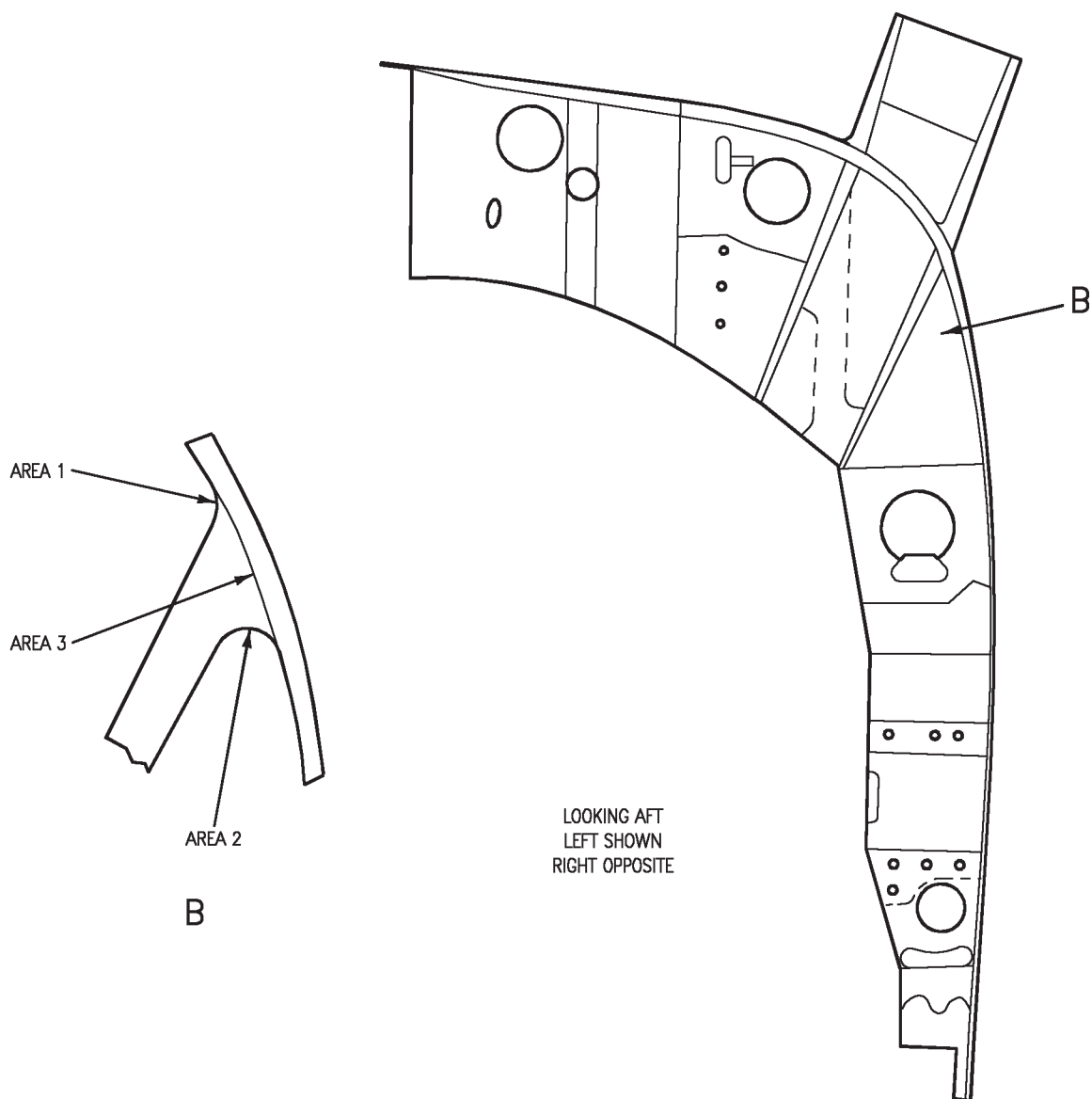
LOOKING FORWARD  
LEFT SHOWN  
RIGHT OPPOSITE

AREA 1  
AREA 2  
AREA 3  
A

**LOCATION**

<input type="checkbox"/> ATSUGI	<input type="checkbox"/> KANEOME	<input type="checkbox"/> NO CRACK INDICATIONS FOUND
<input type="checkbox"/> BEAUFORT	<input type="checkbox"/> LEMOORE	SQUADRON _____
<input type="checkbox"/> CECIL FIELD	<input type="checkbox"/> NEW ORLEANS	BUREAU NO. _____
<input type="checkbox"/> CHINA LAKE	<input type="checkbox"/> NORTH ISLAND	MCAIR CUM NO. _____
<input type="checkbox"/> EL TORO	<input type="checkbox"/> PATUXENT RIVER	FLIGHT HOURS _____
<input type="checkbox"/> FALLON	<input type="checkbox"/> POINT MUGU	NO. OF LANDINGS _____
<input type="checkbox"/> IWAKUNI	<input type="checkbox"/> YUMA	INSPECTION DATE _____
<input type="checkbox"/> JACKSONVILLE		INSPECTOR _____
<input type="checkbox"/> OTHER _____		

**Figure 5. Documentation of Cracked Y598.0 and Y590.5 Formers (Sheet 1)**



## LOCATION

- |                                       |   |
|---------------------------------------|---|
| <input type="checkbox"/> ATSUGI       | <input type="checkbox"/> KANEHOE        |
| <input type="checkbox"/> BEAUFORT     | <input type="checkbox"/> LEMOORE        |
| <input type="checkbox"/> CECIL FIELD  | <input type="checkbox"/> NEW ORLEANS    |
| <input type="checkbox"/> CHINA LAKE   | <input type="checkbox"/> NORTH ISLAND   |
| <input type="checkbox"/> EL TORO      | <input type="checkbox"/> PATUXENT RIVER |
| <input type="checkbox"/> FALLON       | <input type="checkbox"/> POINT MUGU     |
| <input type="checkbox"/> IWAKUNI      | <input type="checkbox"/> YUMA           |
| <input type="checkbox"/> JACKSONVILLE |   |
| <input type="checkbox"/> OTHER _____  |   |

☐ NO CRACK INDICATIONS FOUND

SQUADRON \_\_\_\_\_

BUREAU NO. \_\_\_\_\_

MCAIR CUM NO. \_\_\_\_\_

FLIGHT HOURS \_\_\_\_\_

NO. OF LANDINGS \_\_\_\_\_

INSPECTION DATE \_\_\_\_\_

INSPECTOR \_\_\_\_\_

**Figure 5. Documentation of Cracked Y598.0 and Y590.5 Formers (Sheet 2)**



## INTERMEDIATE MAINTENANCE

## NONDESTRUCTIVE INSPECTION

VERTICAL STABILIZER 77.5 PERCENT SPAR WEB TOOLING  
HOLE CRACKS

PART NO. 74A230720

## Reference Material

Naval Aviation Maintenance Program .....	OPNAVINST 4790.2
Integrated Flight Controls.....	A1-F18AA-570-300
Rudder (84MAS510 or 84MAT511) .....	WP037 00
Integrated Flight Controls.....	A1-F18AC-570-300
Rudder (84MAS510 or 84MAT511) .....	WP024 00
Aircraft Corrosion Control.....	A1-F18AC-SRM-500
Finish System .....	WP012 00
Plane Captain Manual .....	A1-F18AC-PCM-000

## Alphabetical Index

Subject	Page No.
Vertical Stabilizer 77.5 Percent Spar .....	1
Defects .....	1
Post Inspection Cleaning and Corrosion Control.....	4
Primary Inspection Method .....	1
System Securing.....	4

## Record of Applicable Technical Directives

None

**1. VERTICAL STABILIZER 77.5 PERCENT SPAR.** See figure 1.

2. Vertical stabilizer 77.5 percent spar (77.5 percent spar) is made from 7075-T73511 aluminum bar. Finish system is sulfuric acid anodize, epoxy primer, and polyurethane coatings.

3. **DEFECTS.** Inspect 77.5 percent spar for tooling hole cracks.

4. **PRIMARY INSPECTION METHOD.** Primary inspection method is eddy current.

5. **Personnel Qualifications.** Personnel doing this nondestructive inspection should be qualified and certified to do eddy current inspections per OPNAVINST 4790.2 SERIES, NDI Technicians, NEC 7225/MOS 6044.

6. **Preparation of Aircraft.** No special preparation required.

7. **Access.** Have upper rudder fairings removed (A1-F18AA-570-300, WP037 00 or A1-F18AC-570-300, WP024 00), both rudders.

**Support Equipment Required****NOTE**

Alternate item type designations or part numbers are listed in parentheses.

<b>Part Number or Type Designation</b>	<b>Nomenclature</b>
NDT-25N, MXU-713/E	Programmable Eddyscope, Nortec
9505955	Accessory Kit, NDT-25N, Nortec
1RR90F-6-1/2 or Equivalent	Right Angle Surface Probe, Ferrite Shielded, G.K. Engineering Corp, 2 Reqd.
RG 174/U (57A2271)	Microdot to BNC Connecting Cable, 2 Reqd.
ADN-B1	Adapter, Probe Microdot to 12-Pin Burndy (Part of 9505955 Accessory Kit)
VM89A or Equivalent	EDM Notched Hole Reference Standard

**Materials Required**

<b>Specification or Part Number</b>	<b>Nomenclature</b>
MAKE FROM L-P-513-T4-PBG-0.500	Sealant Scrapper
P-D-680, TYPE 2	Dry Cleaning Solvent
CCC-C-46, TYPE 1, CLASS 4	Cleaning Cloth
MIL-P-83953-2, TYPE 1, CLASS A or B, RED or BLACK	Aircraft Marking Pencil

**8. Preparation of Part.**

a. Have sealant removed from tooling hole, if required, with sealant scraper.

**WARNING**

Dry cleaning solvent is flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

b. Clean inspection area with solvent moistened cloth to make sure inspection area is free of contamination or foreign material.

c. Wipe inspection area dry with clean dry cleaning cloth before solvent dries.

**WARNING**

Make sure safety precautions are met for electrical, static, grounding when using eddy current equipment near aircraft fuel cells, oxygen systems, electrical systems, electronic system, and stores (A1-F18AC-PCM-000).

**9. Equipment Settings/Standardization/Setup.**

a. Connect ADN-B1 adapter (adapter) to probe connector on NDT-25N programmable eddyscope (tester).

b. Connect one microdot to BNC connecting cable to front and one to side of adapter.

c. Connect one 1RR90F-6-1/2 right angle surface probe (probe) to each microdot to BNC connecting cable.

**NOTE**

Probe connected to side of adapter is used for reference coil and should be kept away from electrically conductive material.

d. Turn on tester by depressing ON button.

e. Set front face settings as below:

ANGLE.....285°  
 GAIN .....50  
 FREQ KHz .....200  
 FILTER.....0  
 H SENS.....1  
 V SENS.....0.2

f. Press buttons listed below, as required, so red light will be on in upper right corner of applicable button on tester.

H/V .....ON  
 H/T .....OFF  
 V/T .....OFF  
 SP .....OFF  
 TAPE IN.....OFF  
 COMP IN.....OFF  
 ALARM SIZE.....OFF  
 ALARM POS.....OFF  
 MAN X.....OFF  
 STORE PROG .....OFF  
 CALL PROG .....OFF  
 V READ .....OFF  
 H READ .....OFF  
 HORN.....OFF  
 LIGHT.....OFF  
 LATCH.....OFF  
 NON STORE .....OFF

g. Position probe on surface of reference standard, see figure 2.

h. Press NULL button and ERASE button.

i. Press POS button and directional button, as indicated by triangular arrow on button, until dot is centered on CRT.

j. Press NULL button and ERASE button in succession. See figure 3, CRT 1.

#### NOTE

Press ERASE button, as required, in below steps.

k. Adjust ANGLE, as required, to receive trace on CRT similar to trace shown on Figure 3, CRT 2 as probe is lifted off surface of reference standard. Press NULL after each ANGLE adjustment is entered into tester.

l. Scan probe over both EDM notches and edge of reference standard. Traces should appear on CRT similar to those shown on figure 3, CRT 3. If traces are not similar, adjust GAIN and ANGLE until traces are similar. Press NULL after any change(s) to GAIN/ANGLE.

#### 10. Inspection Procedure.

a. Position probe on inspection area.

b. Press NULL button and ERASE button, CRT should appear as shown on figure 4, CRT 1.

#### NOTE

Lift-off will always display traces to left. Tapered section becoming thinner during scanning will display downward trace on CRT. Rocking probe will display trace in lift-off direction and in direction 180 degrees opposite of lift-off, or to right.

c. Lift probe off inspection area to determine lift-off direction.

d. Adjust ANGLE, as required, to have lift-off travel from center of CRT to left as shown in figure 4, CRT 2.

e. Scan around circumference of tooling hole. Index 1/16 inch between scans. Traces similar to figure 4, CRT 3 should be displayed.

f. Press NULL button and ERASE button, as required, to keep CRT pattern similar to CRT presentations shown on figure 4, CRT 3 during scanning. It is acceptable for dot on CRT to travel along lift-off line as long as it remains on CRT. Rescan any area in which cursor has left CRT. Be careful to maintain good contact between probe tip and work, and minimizing rocking of probe.

g. Any traces appearing on CRT having separation angle from lift-off greater than smallest notch depth on reference standard, shall be marked with aircraft marking pencil if indication is repeatable. See figure 3, CRT 3.

## NOTE

Because of variation in conductivity from part-to-part or reference standard-to-reference standard, trace direction may rotate slightly. Parts less conductive than reference standard will have trace rotated counterclockwise. More conductive parts will have traces rotated slightly clockwise from those traces shown in figures 3 and 4.

h. Determine crack length by scanning back and forth perpendicular to crack while indexing along crack centerline.

i. When determining crack length, ends of cracks will be determined when dot returns to center position on CRT. To verify end of crack(s), scan from good area into suspected end of crack, mark area on part where dot begins to raise from centerline with aircraft marking pencil and record.

## WARNING

Dry cleaning solvent is flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

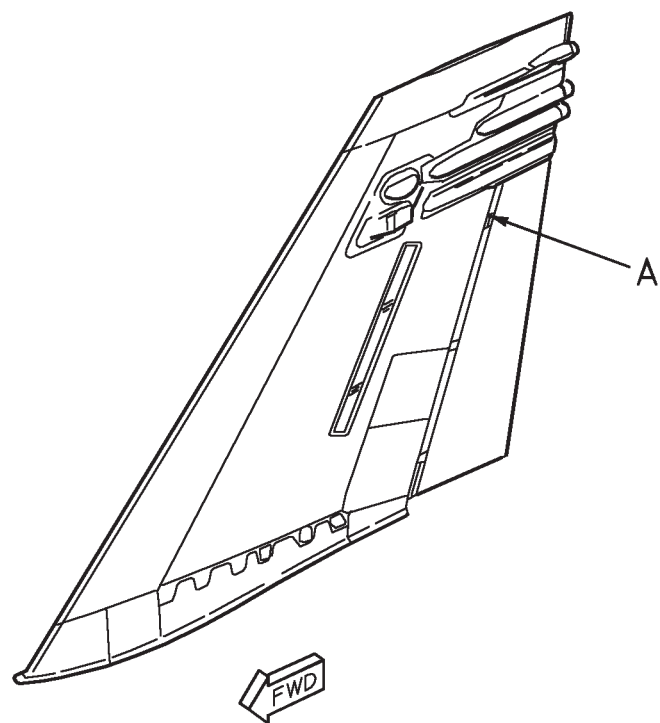
**11. POST INSPECTION CLEANING AND CORROSION CONTROL.** Clean inspection marks, if required, from inspection area with solvent moistened cloth.

**12. SYSTEM SECURING.**

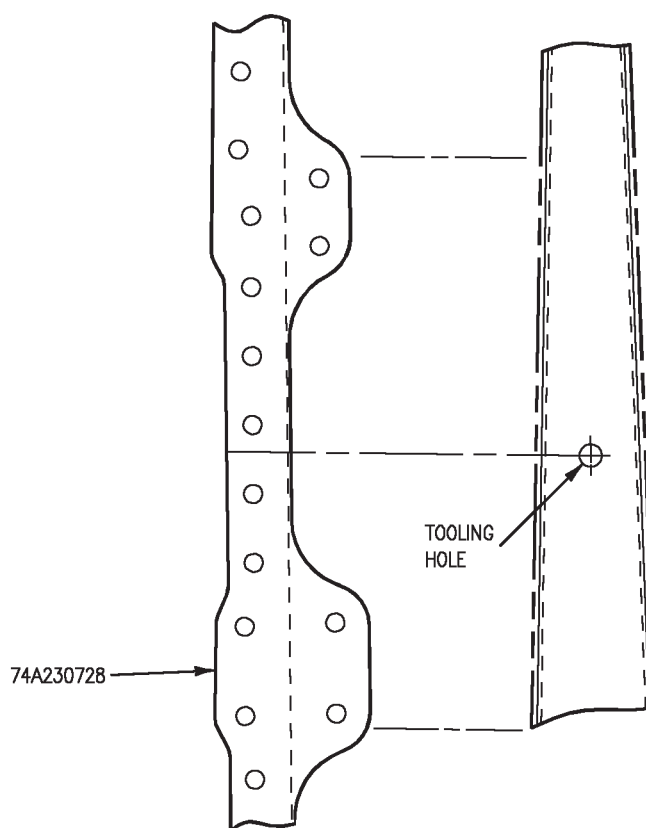
a. Have finish system reapplied (A1-F18AC-SRM-500, WP012 00).

b. Have upper rudder fairings reinstalled (A1-F18AA-570-300, WP037 00 or A1-F18AC-570-300, WP024 00), both rudders.





TYPICAL



A

LOOKING FORWARD

Figure 1. Location of Vertical Stabilizer 77.5 Percent Spar Tooling Hole

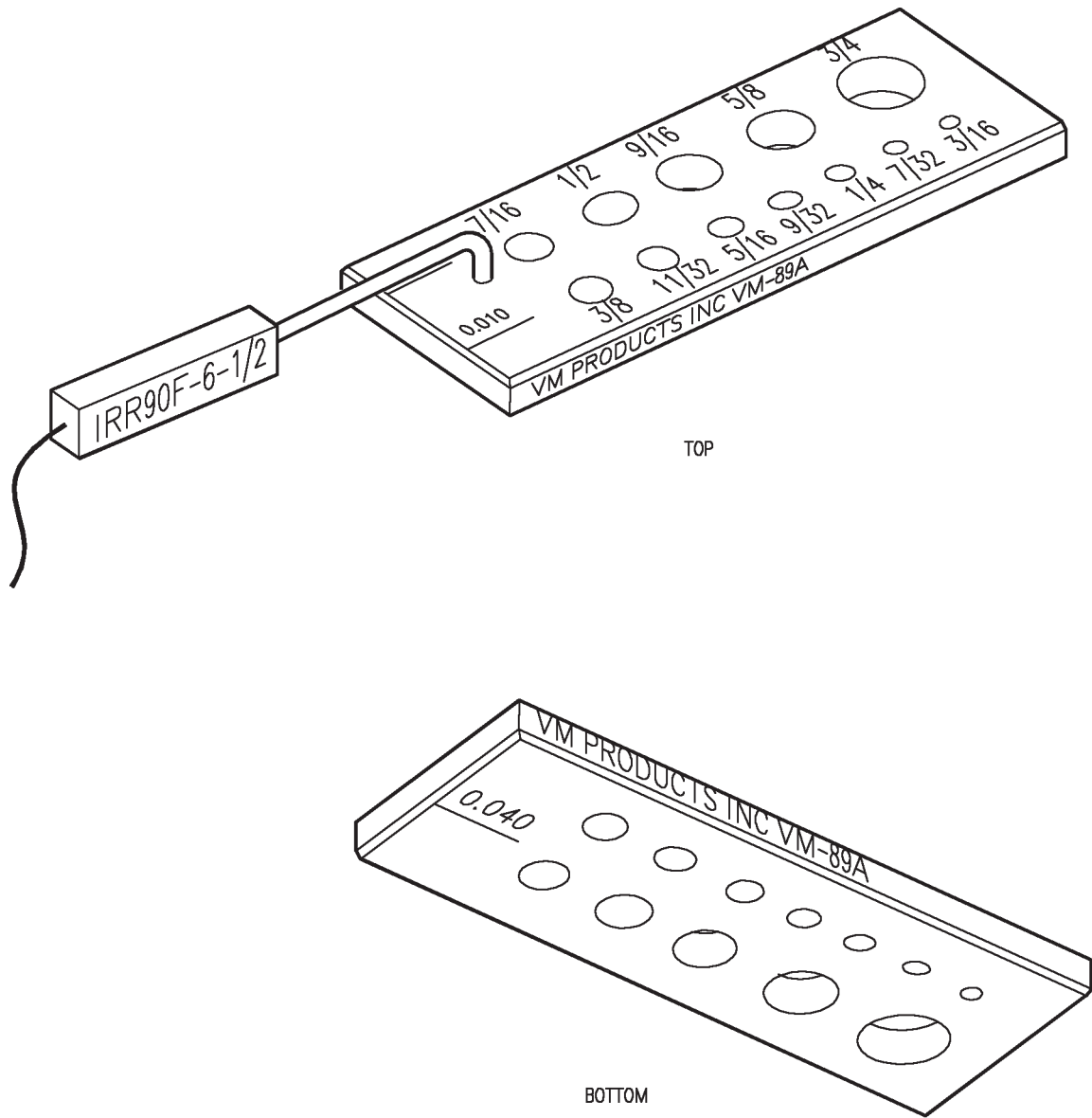


Figure 2. Eddy Current Reference Standard

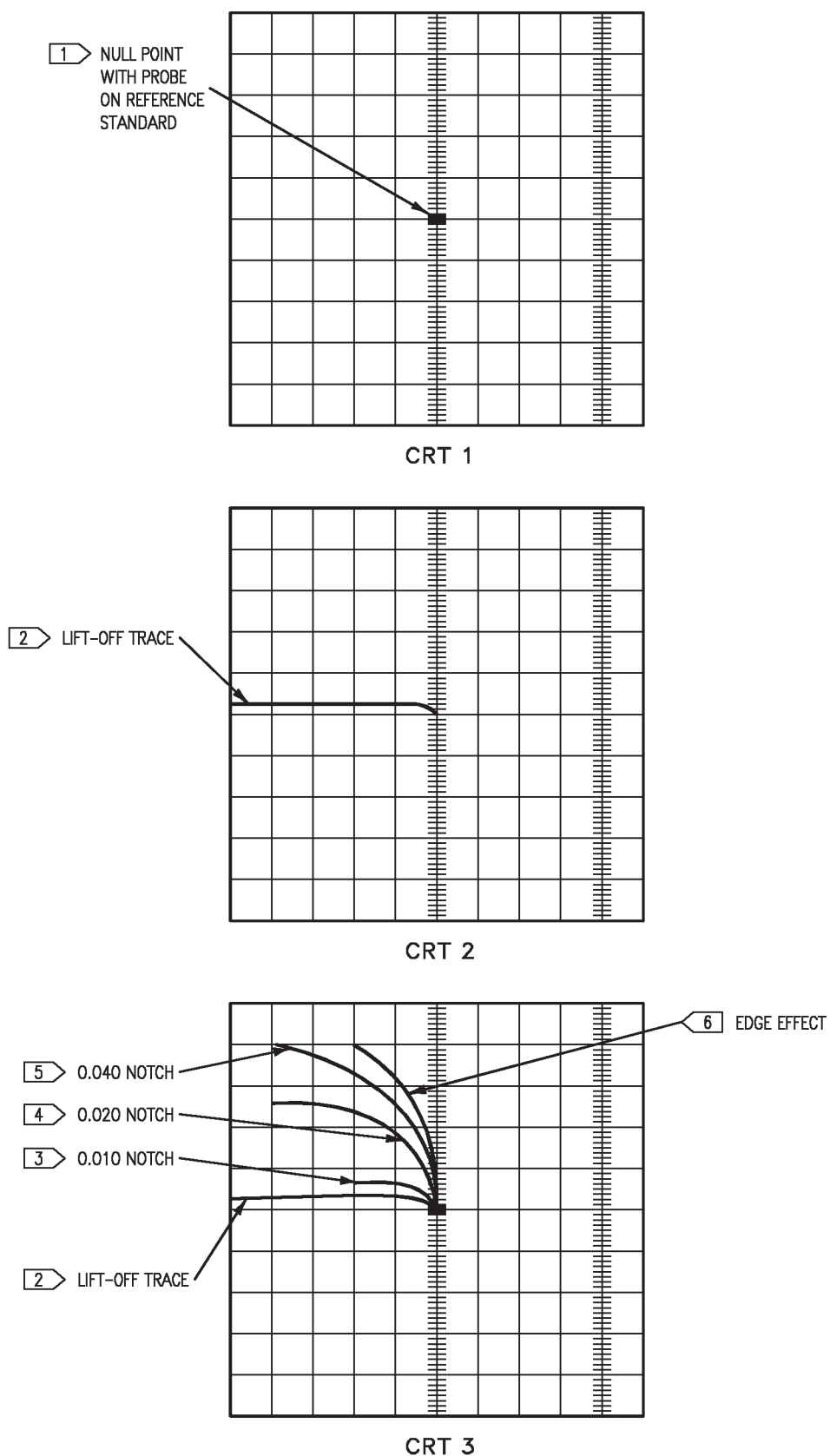
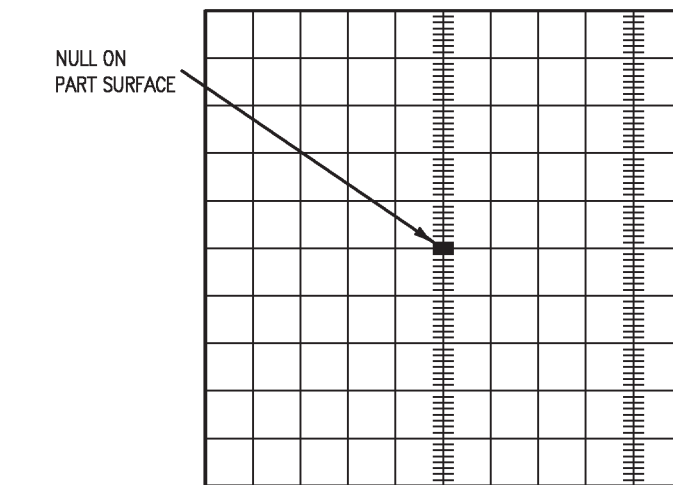


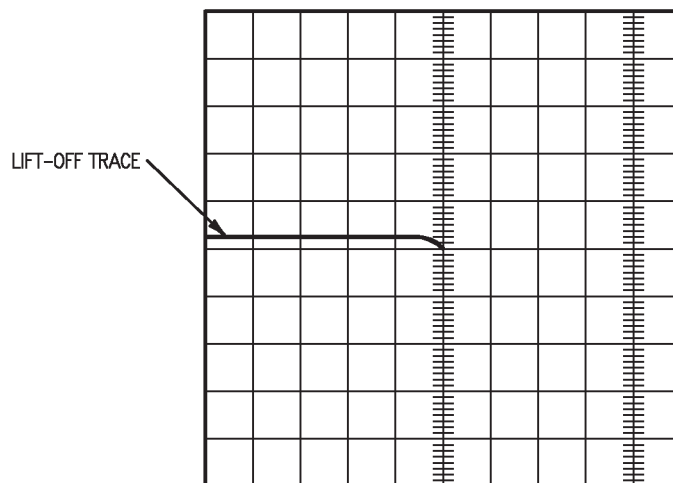
Figure 3. Standardization on Reference Standard (Sheet 1)

## LEGEND

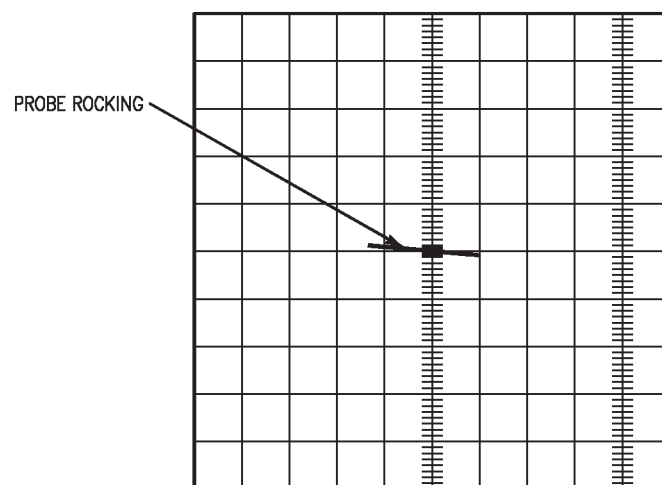
- 1 POSITION PROBE AWAY FROM EDGE OR NOTCH, NORMAL TO REFERENCE STANDARD SURFACE. PRESS POS BUTTON AND THEN PRESS DIRECTIONAL BUTTONS, INDICATED BY TRIANGULAR ARROW ON BUTTON, UNTIL DOT IS IN CENTER OF CRT.
- 2 LIFT-OFF TRACE IS DISPLAYED WHEN PROBE IS REMOVED FROM REFERENCE STANDARD.
- 3 TRACE RESPONSE FROM 0.010 NOTCH.
- 4 TRACE RESPONSE FROM 0.020 NOTCH.
- 5 TRACE RESPONSE FROM 0.040 NOTCH.
- 6 TRACE RESPONSE FROM EDGE OF REFERENCE STANDARD.



CRT 1



CRT 2



CRT 3

**Figure 4. CRT Displays From Surface Inspection of 77.5 Percent Spar Web**



## DEPOT MAINTENANCE

## NONDESTRUCTIVE INSPECTION

## VERTICAL STABILIZER; OUTBOARD FACE OF OUTBOARD FORMER STUB FLANGE ON Y590.500 AND Y598.000 FORMERS

## Reference Material

Naval Aviation Maintenance Program .....	OPNAVINST 4790.2
Line Maintenance Access Doors .....	A1-F18AC-LMM-010
Plane Captain Manual .....	A1-F18AC-PCM-000
Aircraft Weapons System Cleaning and Corrosion Control .....	NAVAIR 01-1A-509
Aircraft Corrosion Control.....	A1-F18AC-SRM-500
Stripping.....	WP007 00
Form in Place Sealing .....	WP010 00
Finish System .....	WP012 00

## Alphabetical Index

Subject	Page No.
Vertical Stabilizer; Outboard Face of Outboard Former Stub Flange on Y590.500 and Y598.000 Formers.....	1
Defects .....	2
Post Inspection Cleaning and Corrosion Control.....	8
Primary Inspection Method .....	2
Safety Precautions .....	2
System Securing.....	8

## Record of Applicable Technical Directives

Type/ Number	Date	Title and ECP No.	Date Incorp.	Remarks
F/A-18 AFB 155	18 Sep 89	Inspection for Fretting Cracks in The L/R Y590.500 and Y598.000 Vertical Stab Attach Formers.	15 Feb 91	-

**1. VERTICAL STABILIZER; OUTBOARD FACE OF OUTBOARD FORMER STUB FLANGE ON Y590.500 AND Y598.000 FORMERS.**

aluminum forging stock, and heat treated to T7351 condition. Finish systems are listed below;

Anodize / one coat of primer  
Anodize / two coats of primer  
IVD / two coats of primer

2. Vertical stabilizer; outboard face of out board former stub flange on Y590.500 and Y598.000 formers (former stubs) are machined from 7050

3. **SAFETY PRECAUTIONS.** Make sure safety requirements for electrical, static, grounding when using ultrasonic equipment near aircraft fuel cells, oxygen systems, electrical systems, electronic systems and stores have been met (A1-F18AC-PCM-000).

4. **DEFECTS.** Inspect for fretting wear / fatigue cracks on former stubs at approximately 0.1 and 0.25 inches from edge of fastener hole, and for corner cracks. See figure 2. Fretting wear / fatigue cracks start when fretting wear occurs between tight fitting surfaces subjected to low cycle fatigue.

5. **PRIMARY INSPECTION METHOD.** Primary inspection method is contact pulse-echo shear wave ultrasonics.

6. **Personnel Qualifications.** Personnel doing this nondestructive inspection should be qualified and certified to do magnetic particle inspections per OPNAVINST 4790.2 SERIES, NDI Technicians, NEC 7225 / MOS 6044 and shall have special Certification Record ( OPNAV 4790 / 139).

7. **Preparation of Aircraft.** No special preparation required.

8. **Access.** Have doors 88 L / R and 89 L / R removed (A1-F18AC-LMM-010).

### Support Equipment Required

Part Number or Type Designation	Nomenclature
C-398 (303B)	Ultrasonic Flaw Detector
57A2271	Microdot to BNC Connecting Cable
226590 MSW-QC SERIES	Zero Degree, 0.250 Dia. Element, 10 MHz, Search unit, K. B. Aerotech Lewistown, PA.
74SB2484-W1	Search Unit Wedge For Y590.500 and Y598.000 Formers (get from local MCAIR Rep.)
74SB2484-1	Y598.000 Reference Standard

### Support Equipment Required (Continued)

Part Number or Type Designation	Nomenclature
74SB2484-LD1	Search Unit Locating Device For Y590.500 and Y598.000 Formers (get from local MCAIR Rep)
74SB2484-P1	Pins (get from local MCAIR Rep)
74SB2484-3	Y590.500 Reference Standard
74SB2484-2	Y598.000 EDM Notch Reference Standard
74SB2484-4	Y590.500 EDM Notch Reference Standard
74SB2484-T1	Titanium Tapered Shim Stock
10L1280-36	DOTCO Right Angle Grinder, 12,000 RPM (MCAIR Tool Code Number UB10)DOTCO / Cooper AirTools Lexington, SC. 29072
SG 250	Carbide Rotary file, conical Tip (MCAIR-TFIM 25. 0006531) SGS Tool Co. Munroe Falls, OH. 44262

### Materials Required

Specification or Part Number	Nomenclature
MILR81294TY1CL 020X413	Paint Remover
MILC87962TYPE1	Cleaning Compound
ULTRAGEL II	Cleaning Cloth
M83953-1 or -2	Ultrasonic Couplant
	Pencil, Aircraft Marking



**Materials Required (Continued)****Specification  
or Part Number****Nomenclature**

TYPE 105	Polyken, Double Sided Adhesive Tape, 2 Inch, Kendall Co., Polyken Div. Boston, MA. 02102
L-P-513-T4-PBG-0.500	Sealant Scraper, Fabricate
6-143	Disposable Applicator, Cotton Swab, Q Tip
MILS83430CLASSB-4	Sealing Compound

**9. Preparation of Part.** See figure 2.

a. Have paint and sealant removed from lower fastener heads on Y590.500 and Y598.000 former stub flanges, using plastic scraper (NAVAIR 01-1A-509).

**NOTE**

Step b. will only be done for first inspection.

b. Have button shim trimmed flush with titanium step plate. See figure 1 and substeps below;

(1) Slide tapered titanium shim between aluminum button shim and former stub flange.

(2) Use DOTCO right angle grinder with conical tipped rotary file to carefully grind button shim flush with titanium step plate. Do not try to grind through button shim in one pass. A series of lightcuts should be used to trim button shim.

(3) Have paint removed from inboard and outboard face of former stub flange (A1-F18AC-SRM-500, WP007 00).

**WARNING**

Cleaning compound is a flammable liquid and vapor. May cause allergic respiratory and skin reaction. May cause eye, skin and respiratory irritation. Keep away from heat, sparks, and flame. Do not breathe dust (vapor, mist, gas). Use only with adequate ventilation. Keep container closed. Avoid contact with eyes, skin and clothing. Wash thoroughly after handling.

c. Clean inspection area and exposed fastener heads with cleaning cloth moistened with cleaning compound. Allow to air dry for 15 minutes.

**10. Equipment Settings/ Standardization/ Setup.**

a. Clean I.D. of fastener holes and inspection area below lower fastener holes on each reference standard with cleaning cloth moistened with cleaning compound. This ensures that the inspection area is free of contamination or foreign material. Allow to air dry for 15 minutes. See figure 3.

b. Y598.000 Former stub;

**NOTE**

Reference standards 74SB2484-1 and 74SB2484-2 are same except 74SB2484-2 reference standard has an electrical discharge machined (EDM) notch around bottom of lower fastener holes.

(1) Connect search unit and cable to ultrasonic flaw detector (tester).

(2) Turn on POWER, allow 15 minutes warmup.

(3) Set front face settings as listed below;

## NOTE

Equipment differences may require use of alternate COARSE SWEEP RANGE, FINE SWEEP RANGE, DAMPING, and REJECT settings.

COARSE SWEEP  
 RANGE ..... 5.0 INCHES  
 ATTENUATORS:  
 OUT ..... 2,8,16, and 32  
 IN ..... 4  
 FILTER..... ON  
 COARSE SWEEP  
 DELAY ..... 0-3 INCHES  
 FINE SWEEP  
 DELAY ..... APPROX 5  
 FREQ..... 10.0 MHz  
 MODE ..... PULSE ECHO  
 FINE GAIN..... MAX  
 COARSE GAIN ..... APPROX 4  
 REP RATE..... AUTO  
 FINE SWEEP  
 RANGE ..... MID SCALE  
 DAMPING..... APPROX 7  
 REJECT..... 1  
 VIDEO DISPLAY ..... FULL WAVE

(4) Put small amount of couplant into search unit well of 74SB2484-W1 Wedge (wedge).

(5) Install search unit into wedge.

(6) With search unit / wedge held in the air, uncoupled from any surface, adjust FINE SWEEP DELAY to find initial pulse, see figure 4, CRT 1.

(7) Apply couplant to face of wedge and finger damp.

(8) Adjust FINE SWEEP DELAY to position response from face of wedge at approximately one on the horizontal baseline, see figure 4, CRT 2.

(9) Cut and attach piece of double sided tape to fit base of two 74SB2484-P1 pins.

## NOTE

There are no EDM notches in 74SB2484-1 reference standard. CRT response will be indicative of inspecting flange without fretting cracks.

(10) Attach one pin over empty fastener hole in 74SB2484-1 reference standard.

(11) Attach second pin over nearby fastener head.

(12) Apply couplant to inspection area of reference standard, see figure 3. Apply additional couplant during standardization, as required, to prevent drying of couplant.

(13) Attach search unit locating device (locating device) to pin over empty fastener hole.

(14) Locate wedge on reference standard so wedge slides smoothly between guides of locating device, see figure.

(15) Slide, sweep, and swivel wedge, as required, to locate outboard corner of fastener hole on reference standard.

(16) Verify corner response by putting cotton swab moistened with couplant into I.D. of empty fastener hole and damp corner.

## NOTE

The response from wedge / air interface may move to left, possibly off CRT.

(17) Adjust FINE SWEEP RANGE, as required, so response from outboard corner of fastener hole is at 5.0 on the horizontal baseline.

(18) Adjust COARSE GAIN, as required, to get peak amplitude of 90 percent for response at 5.0 on the horizontal baseline. CRT response should be approximately same as figure 5, CRT 1. Any responses less than 3.5 on the horizontal baseline are because of sound beam reflections in wedge.

(19) Match mark, wedge and locating device, with aircraft marking pencil so CRT response at 5.0 will be repeated when marks are aligned.

(20) Position locating device on pin over nearby fastener on reference standard.

(21) Align marks on wedge and locating device. CRT response should be similar to figure 5, CRT 1. Any responses less than 3.5 on the horizontal baseline are because of sound beam reflections in wedge. Response at 5.0 on the

horizontal baseline is because of outboard corner, edge, of fastener hole. This may be verified only by comparison to nearby hole without fastener installed.



(22) Adjust ATTENUATOR switches, as required, to either raise or lower response at 5.0 to approximately 90 percent of CRT height.

(23) Cut and attach piece of double sided tape to fit base of two 74SB2484-P1 pins.

## NOTE

EDM notch in 74SB2484-2 reference standard simulates former stub with fretting wear / fatigue cracks. Similar responses should be displayed on former stubs that are cracked.

(24) Attach one pin over empty fastener hole in 74SB2484-2 reference standard.

(25) Attach second pin over nearby fastener.

(26) Apply couplant to inspection area of reference standard, see figure 3. Apply additional couplant during standardization, as required, to prevent drying of couplant.

(27) Attach locating device to pin over empty fastener hole.

(28) Locate wedge on reference standard so wedge slides smoothly between guides of locating device, see figure.

(29) Align marks on wedge and locating device. A response should appear at 5.0 on the horizontal baseline.

(30) Verify corner response by putting cotton swab moistened with couplant into I.D. of empty fastener hole and damp corner.

(31) If response does not appear sweep and swivel wedge, as required, to locate outboard corner of fastener hole on reference standard.

(32) Adjust FINE SWEEP RANGE, as required, so response from outboard corner of fastener hole is at 5.0 on the horizontal baseline. Response at 4.7 on the horizontal baseline represents EDM notch.

(33) Adjust COARSE GAIN, if required, to get peak amplitude of 90 percent for EDM notch response. CRT response should be approximately same as found in figure 5, CRT 2.

(34) Position locating device on pin over nearby lower fastener on reference standard.

(35) Align marks on wedge and locating device. CRT response should be similar to figure 5, CRT 2. Any responses less than 3.5 on the horizontal baseline are because of sound beam reflections in wedge. Response at 5.0 on the horizontal baseline is because of outboard corner, edge, of fastener hole. This may be verified only by comparison to nearby hole without fastener installed. Response at approximately 4.7 on the horizontal baseline represents EDM notch on reference standard.

(36) Adjust ATTENUATOR switches, as required, to either raise or lower EDM notch response to 90 percent of CRT height.

## NOTE

Do not change or adjust any RANGE or DELAY knobs on the tester.

(37) Tester is now standardized to do inspection of R / L Y598.000 former stub.

c. Y590.500 Former stub;

## NOTE

Reference standards 74SB2484-3 and 74SB2484-4 are same except 74SB2484-4 reference standard has an electrical discharge machined (EDM) notch around bottom of lower fastener holes.

(1) Connect search unit and cable to tester.

(2) Turn on POWER, allow 15 minutes warmup.

(3) Set front face settings as listed below;

## NOTE

Equipment differences may require use of alternate COARSE SWEEP RANGE, FINE SWEEP RANGE, DAMPING, and REJECT settings.

COARSE SWEEP  
 RANGE ..... 5.0 INCHES  
 ATTENUATORS:  
 OUT ..... 2,8,16, and 32  
 IN ..... 4  
 FILTER..... ON  
 COARSE SWEEP  
 DELAY ..... 0-3 INCHES  
 FINE SWEEP  
 DELAY ..... APPROX 5  
 FREQ..... 10.0 MHz  
 MODE ..... PULSE ECHO  
 FINE GAIN..... MAX  
 COARSE GAIN ..... APPROX 4  
 REP RATE..... AUTO  
 FINE SWEEP  
 RANGE..... MID SCALE  
 DAMPING..... APPROX 7  
 REJECT..... 1  
 VIDEO DISPLAY ..... FULL WAVE

(4) Put small amount of couplant into search unit well of 74SB2484-W1 Wedge (wedge).

(5) Install search unit into wedge.

(6) With search unit / wedge held in the air, uncoupled from any surface, adjust FINE SWEEP DELAY to find initial pulse, see figure 4, CRT 1.

(7) Apply couplant to face of wedge and finger damp.

(8) Adjust FINE SWEEP DELAY to position response from face of wedge at approximately one on the horizontal baseline, see figure 4, CRT 2.

(9) Cut and attach piece of double sided tape to fit base of two 74SB2484-P1 pins.

## NOTE

There are no EDM notches in 74SB2484-3 reference standard. CRT response will be indicative of inspecting flange without fretting cracks.

(10) Attach one pin over empty fastener hole in 74SB2484-3 reference standard.

(11) Attach second pin over nearby fastener head.

(12) Apply couplant to inspection area of reference standard, see figure 3. Apply additional couplant during standardization, as required, to prevent drying of couplant.

(13) Attach search unit locating device (locating device) to pin over empty fastener hole.

(14) Locate wedge on reference standard so wedge slides smoothly between guides of locating device, see figure.

(15) Slide, sweep, and swivel wedge, as required, to locate outboard corner of fastener hole on reference standard.

(16) Verify corner response by putting cotton swab moistened with couplant into I.D. of empty fastener hole and damp corner.

## NOTE

The response from wedge / air interface may move to left, possibly off CRT.

(17) Adjust FINE SWEEP RANGE, as required, so response from outboard corner of fastener hole is at 5.0 on the horizontal baseline.

(18) Adjust COARSE GAIN, as required, to get peak amplitude of 90 percent for response at 5.0 on the horizontal baseline. CRT response should be approximately same as figure 5, CRT 1. Any responses less than 3.5 on the horizontal baseline are because of sound beam reflections in wedge.

(19) Match mark, wedge and locating device, with aircraft marking pencil so CRT response at 5.0 will be repeated when marks are aligned.

(20) Position locating device on pin over nearby fastener on reference standard.

(21) Align marks on wedge and locating device. CRT response should be similar to figure 5, CRT 1. Any responses less than 3.5 on the horizontal baseline are because of sound beam reflections in wedge. Response at 5.0 on the horizontal baseline is because of outboard corner, edge, of fastener hole. This may be verified only by comparison to nearby hole without fastener installed.

(22) Adjust ATTENUATOR switches, as required, to either raise or lower response at 5.0 to approximately 90 percent of CRT height.

(23) Cut and attach piece of double sided tape to fit base of two 74SB2484-P1 pins.

## NOTE

EDM notch in 74SB2484-4 reference standard simulates former stub with fretting wear / fatigue cracks. Similar responses should be displayed on former stubs that are cracked.

(24) Attach one pin over empty fastener hole in 74SB2484-4 reference standard.

## NOTE

EDM notch in 74SB2484-2 reference standard simulates former stub with fretting wear / fatigue cracks. Similar responses should be displayed on former stubs that are cracked.

(25) Attach one pin over empty fastener hole in 74SB2484-2 reference standard.

(26) Attach second pin over nearby fastener.

(27) Apply couplant to inspection area of reference standard, see figure 3. Apply additional couplant during standardization, as required, to prevent drying of couplant.

(28) Attach locating device to pin over empty fastener hole.

(29) Locate wedge on reference standard so wedge slides smoothly between guides of locating device, see figure.

(30) Align marks on wedge and locating device. A response should appear at 5.0 on the horizontal baseline.

(31) Verify corner response by putting cotton swab moistened with couplant into I.D. of empty fastener hole and damp corner.

(32) If response does not appear sweep and swivel wedge, as required, to locate outboard corner of fastener hole on reference standard.

(33) Adjust FINE SWEEP RANGE, as required, so response from outboard corner of fastener hole is at 5.0 on the horizontal baseline. Response at 4.7 on the horizontal baseline represents EDM notch.

(34) Adjust COARSE GAIN, if required, to get peak amplitude of 90 percent for EDM notch response. CRT response should be approximately same as found in figure 5, CRT 2.

(35) Position locating device on pin over nearby lower fastener on reference standard.

(36) Align marks on wedge and locating device. CRT response should be similar to figure 5, CRT 2. Any responses less than 3.5 on the horizontal baseline are because of sound beam reflections in wedge. Response at 5.0 on the horizontal baseline is because of outboard corner, edge, of fastener hole. This may be verified only by comparison to nearby hole without fastener installed. Response at approximately 4.7 on the horizontal baseline represents EDM notch on reference standard.

(37) Adjust ATTENUATOR switches, as required, to either raise or lower EDM notch response to 90 percent of CRT height.

## NOTE

Do not change or adjust any RANGE or DELAY knobs on the tester.

(38) Tester is now standardized to do inspection of R / L Y590.000 former stub.

**11. Inspection Procedure.** The following steps shall be done on both left and right Y590.500 and Y598.000 former stubs.

a. Cut and attach piece of double sided tape to fit base of two 74SB2484-P1 pins.



b. Attach one pin over forward fastener head on former stub.

c. Attach one pin over aft fastener head on former stub.

d. Apply couplant to inspection area of former stub. Apply couplant, as required, during inspection to prevent drying of couplant.

e. Attach locating device to pin over forward fastener head.

f. Position wedge in locating device so wedge slides smoothly between guides.

g. Align marks on wedge and locating device, these are the marks made during standardization. CRT response should be approximately same as figure 5, CRT 1.

h. Attach locating device to pin over aft fastener head.

i. Position wedge in locating device so wedge slides smoothly between guides.

j. Align marks on wedge and locating device, these are the marks made during standardization. CRT response should be approximately same as figure 5, CRT 1.

k. Fastener holes without fretting cracks will have CRT displays similar to those in figure 5, CRT 1. Any response less than 3.5 on the horizontal baseline are due to sound beam reflections in wedge.

l. Fastener holes with fretting cracks will have CRT displays similar to those in figure 5, CRT 2. Crack response will be similar to EDM notch response.

m. Figure 6, CRT 1, shows range of crack response that may be displayed on CRT.

n. CRT crack response shall have amplitude of 30 percent with equipment set at same gain settings used to get 90 percent amplitude response from EDM notched reference standard during standardization.

12. **Documentation of Inspection Results.** A documentation sheet has been provided to be used for each aircraft inspected, see figure 7.

### 13. POST INSPECTION CLEANING AND CORROSION CONTROL.

#### WARNING

Cleaning compound is a flammable liquid and vapor. May cause allergic respiratory and skin reaction. May cause eye, skin and respiratory irritation. Keep away from heat, sparks, and flame. Do not breathe dust (vapor, mist, gas). Use only with adequate ventilation. Keep container closed. Avoid contact with eyes, skin and clothing. Wash thoroughly after handling.

a. Clean couplant and markings from inspection areas with cleaning cloth moistened with cleaning compound. Allow to air dry for 15 minutes.

b. Have finish system reapplied (A1-F18AC-SRM-500, WP012 00).

c. Have form-in place seal replaced on rabbet of vertical tail titanium step plate (A1-F18AC-SRM-500, WP010 00).

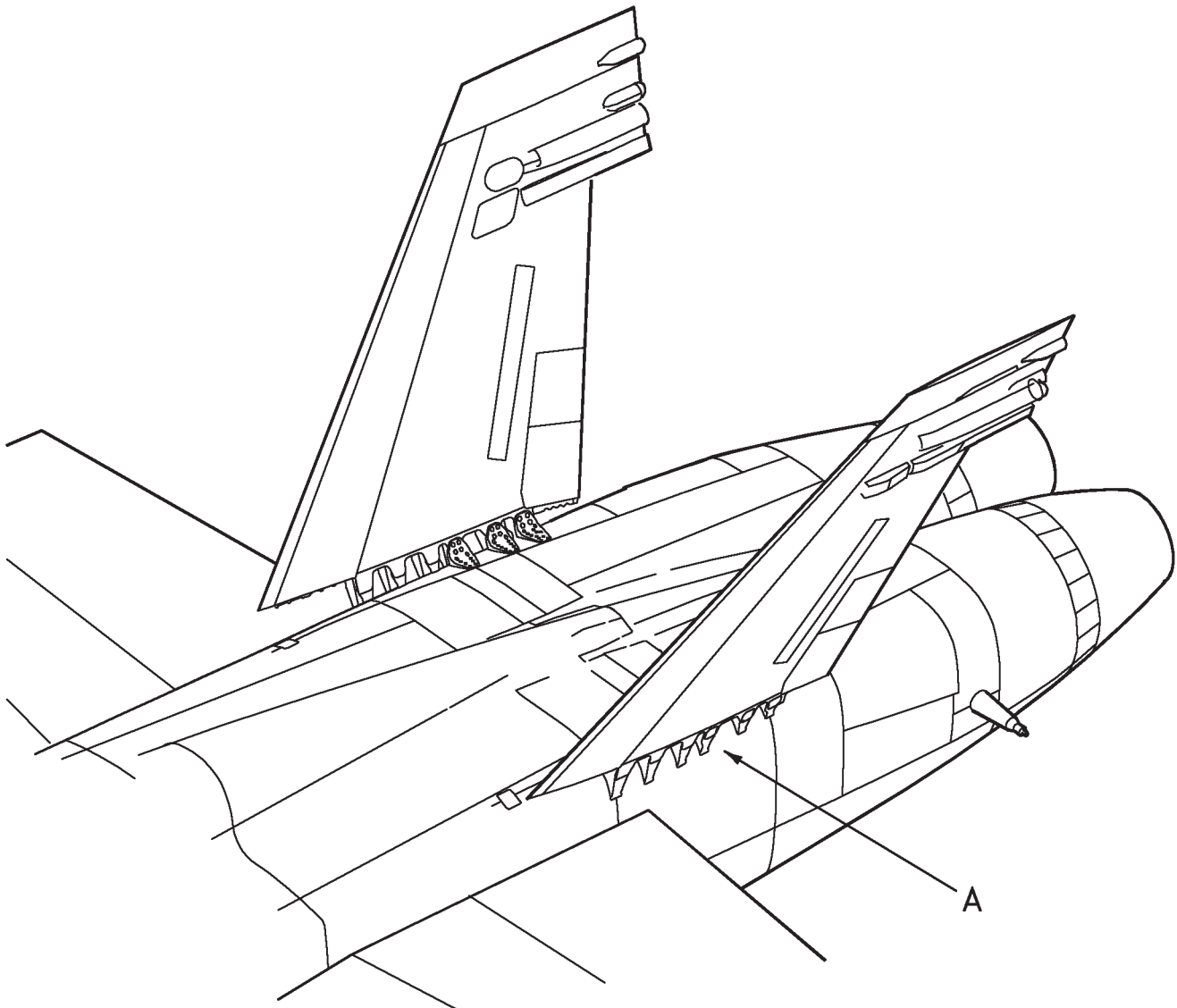
#### WARNING

Sealing compound is flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

d. Have sealing compound replaced on stub flange in area shown in figure 8 and (A1-F18AC-SRM-500, WP010 00). Sealing compound shall be built up to same level as rabbet on titanium step plate.

14. **SYSTEM SECURING.** Have doors 88 L / R and 89 L / R reinstalled (A1-F18AC-LMM-010).





DOOR 88 AND 89 REMOVED

Figure 1. Ultrasonic Inspection Area (Sheet 1)

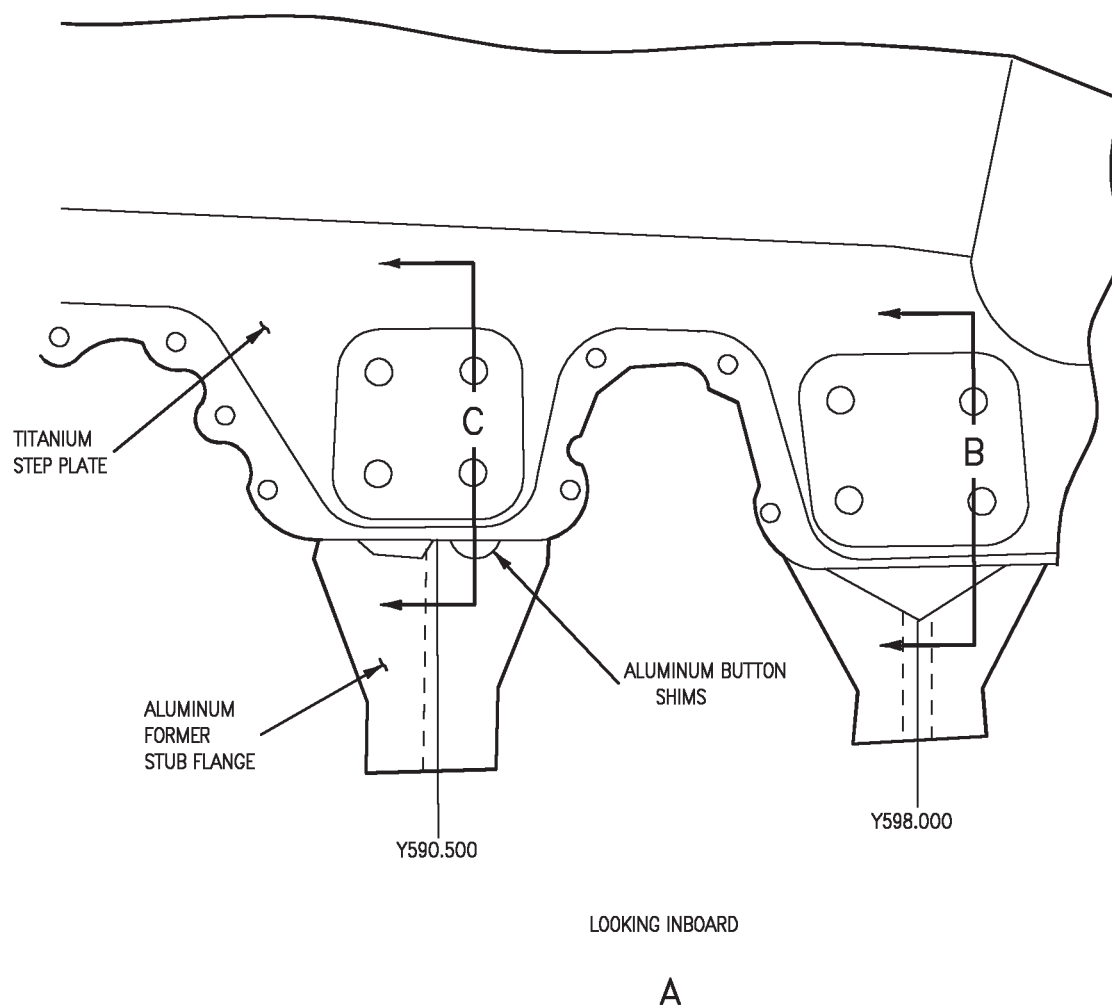


Figure 1. Ultrasonic Inspection Area (Sheet 2)

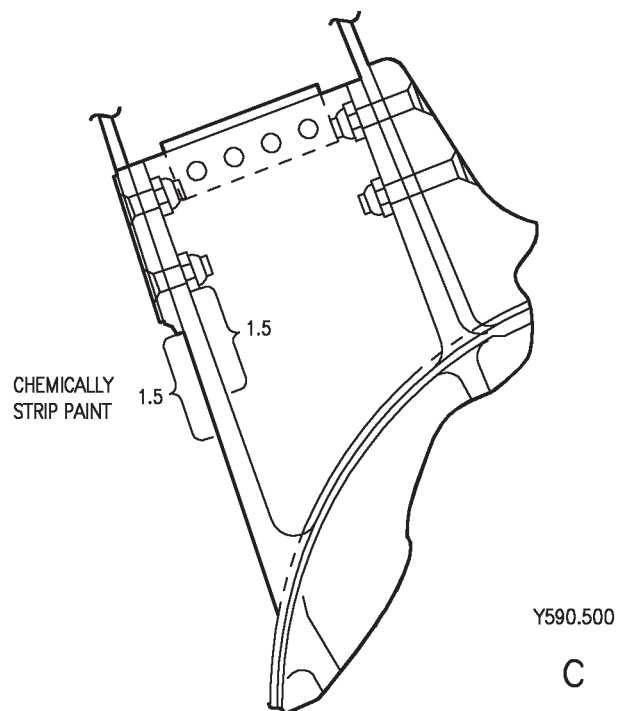
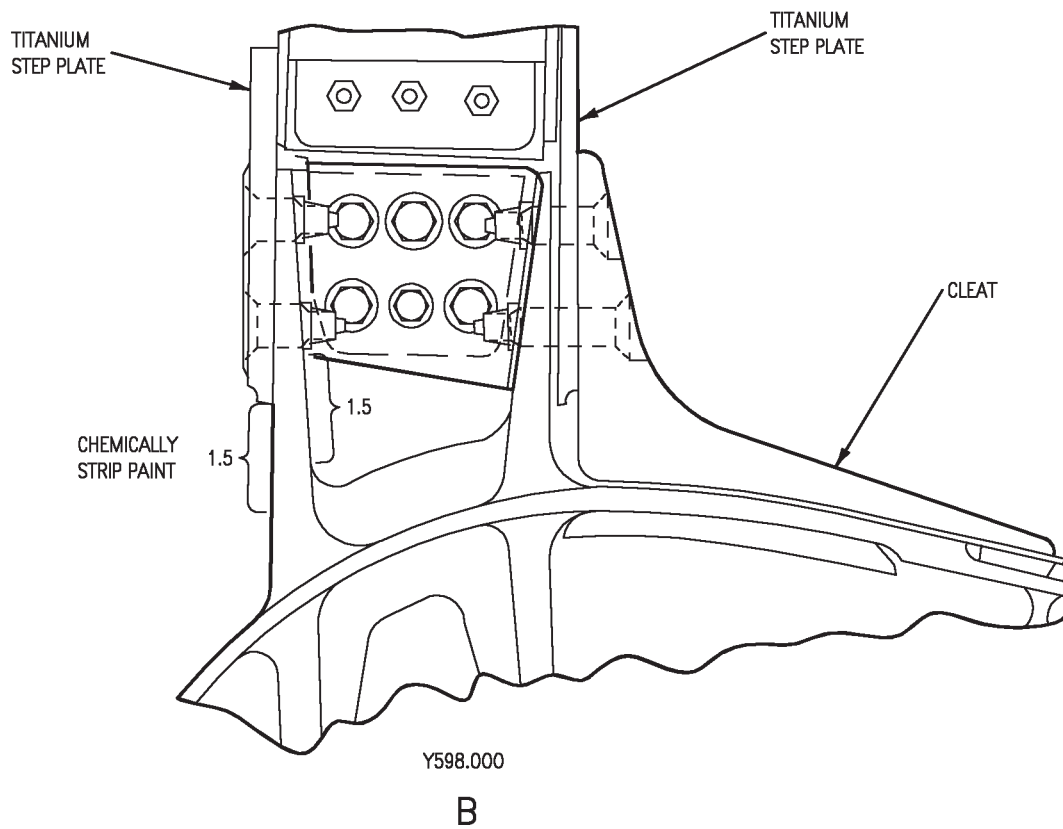
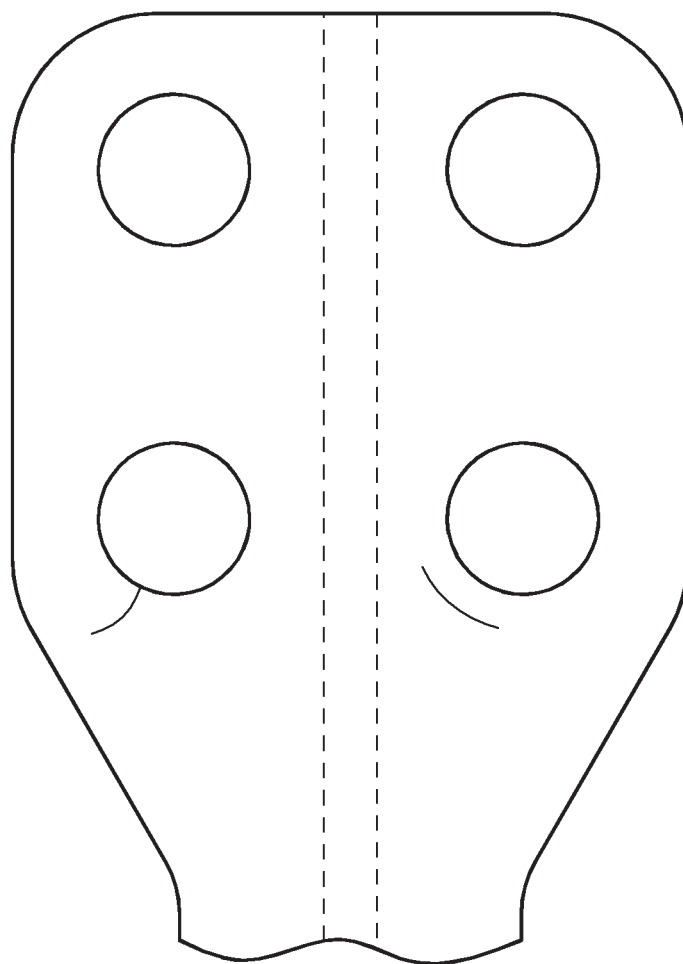


Figure 1. Ultrasonic Inspection Area (Sheet 3)



ALUMINUM  
FORMER  
STUB FLANGE

Figure 2. Typical Fretting Wear / Fatigue Cracks

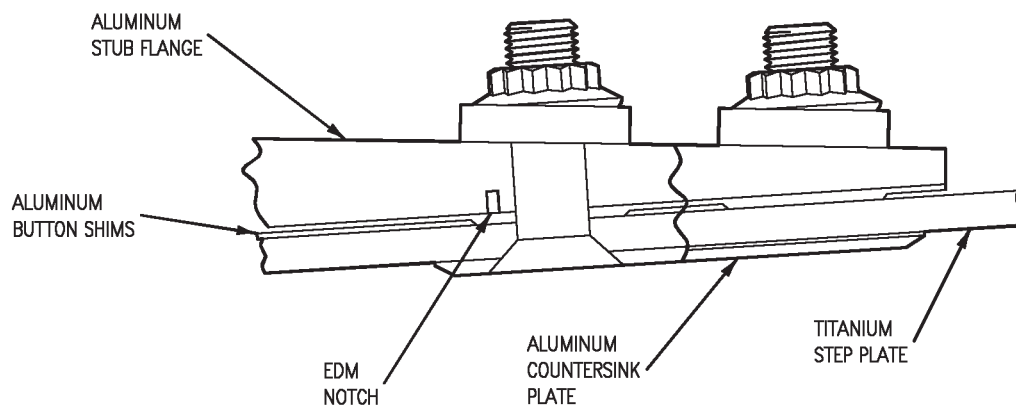
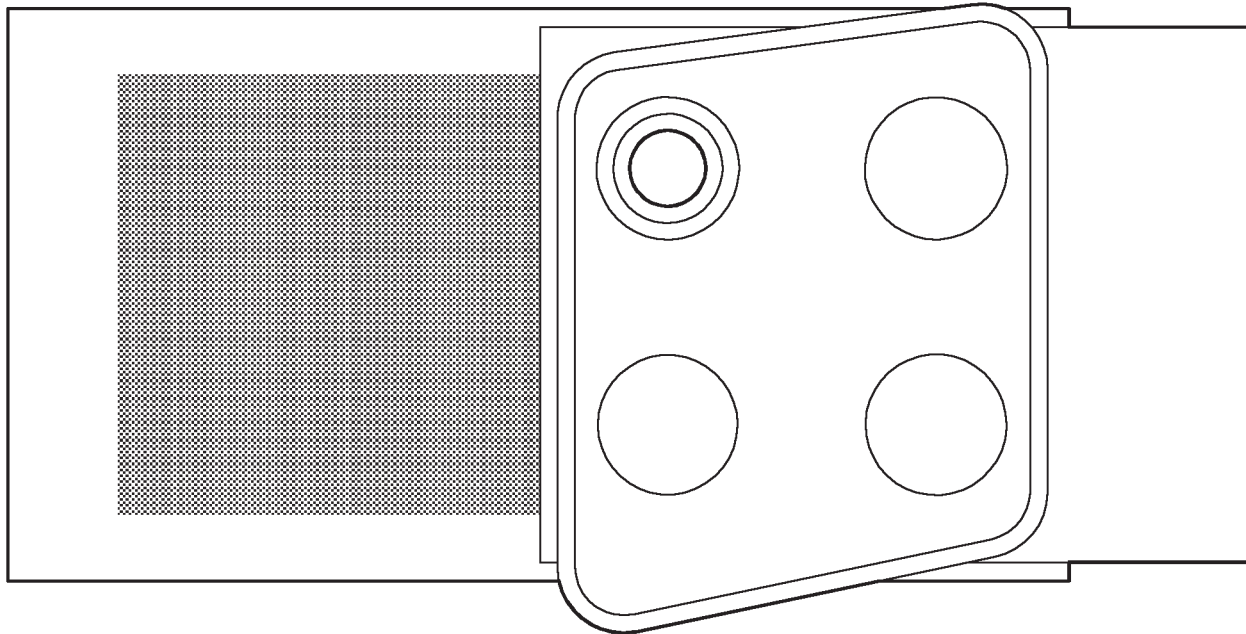
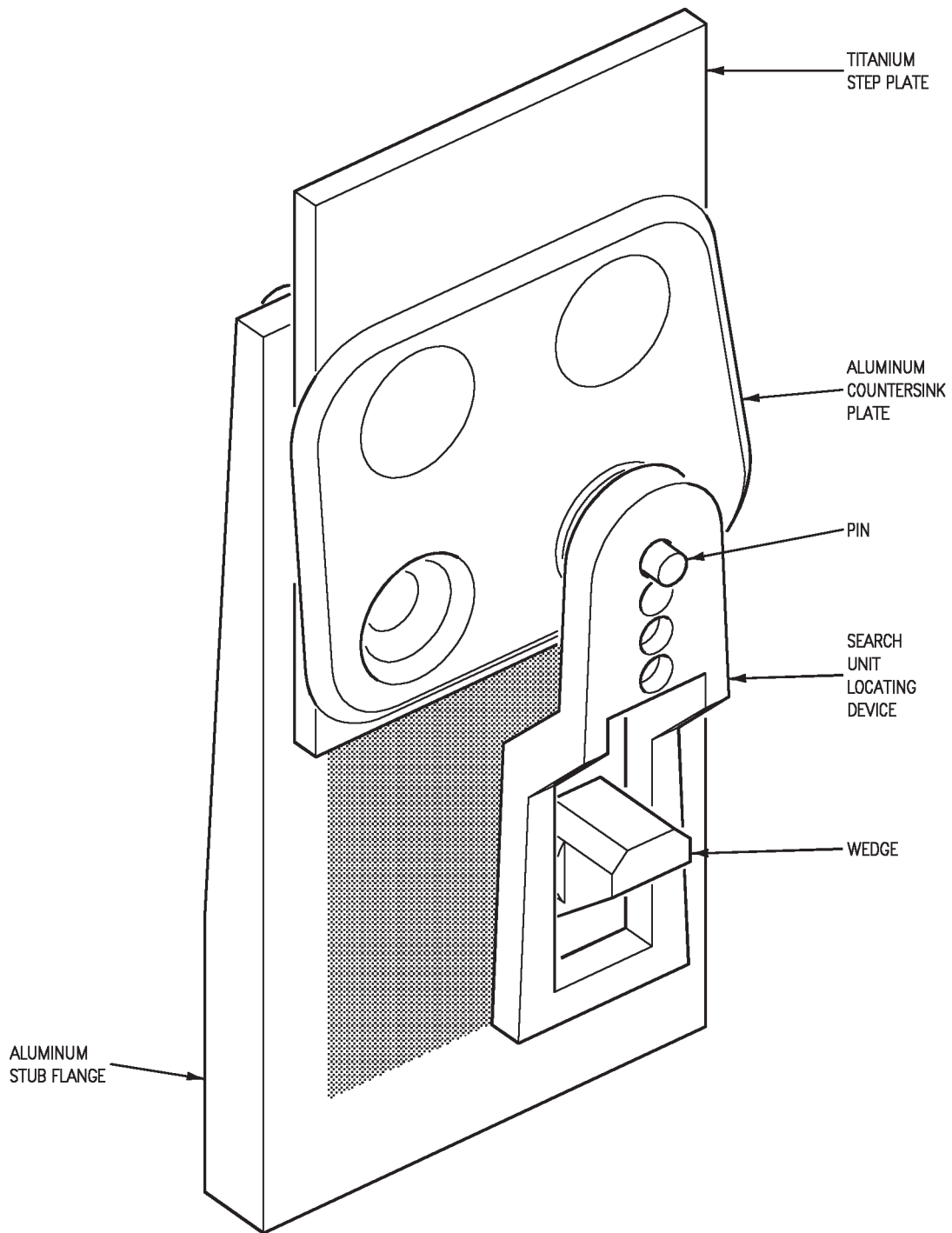


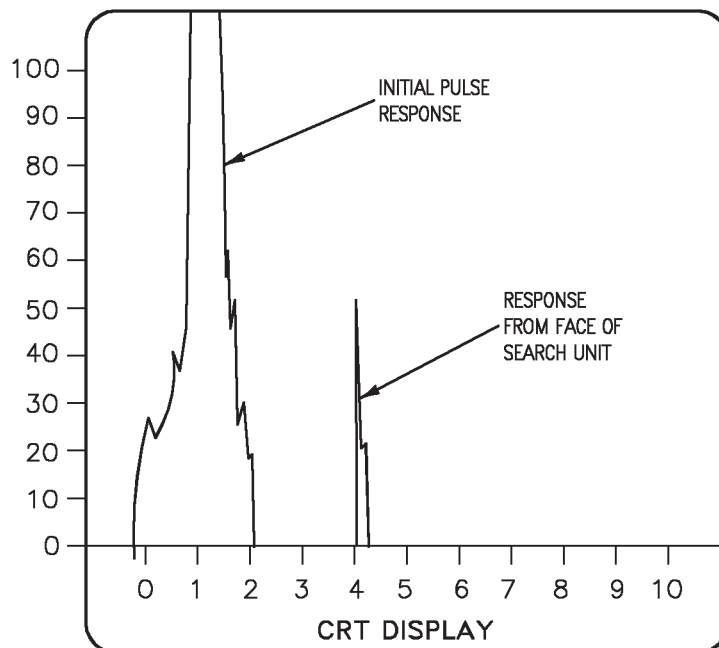
Figure 3. Fretting Wear / Fatigue Crack Ultrasonic Reference Standard (Sheet 1)



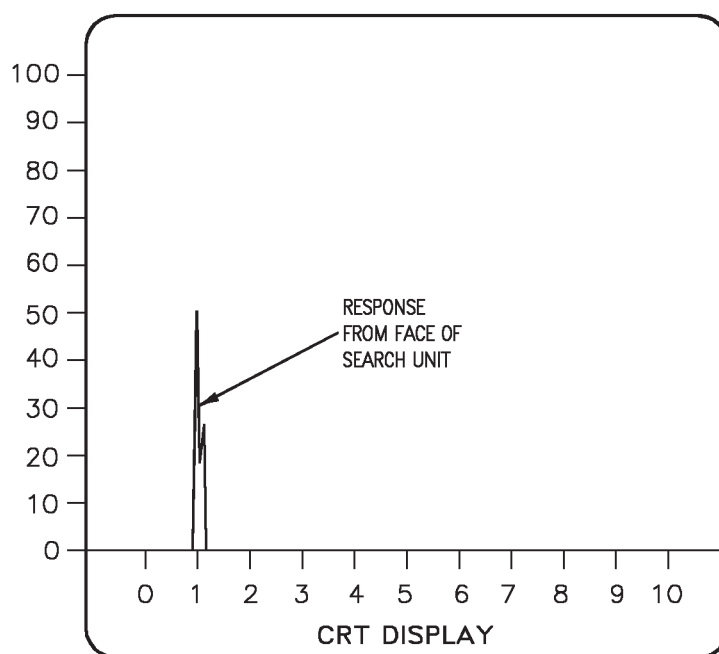
LEGEND



Figure 3. Fretting Wear / Fatigue Crack Ultrasonic Reference Standard (Sheet 2)

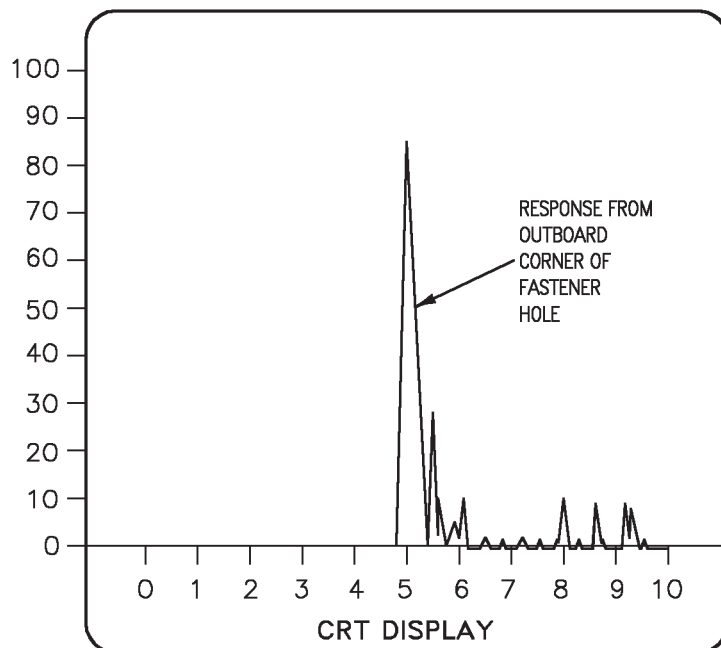


CRT 1

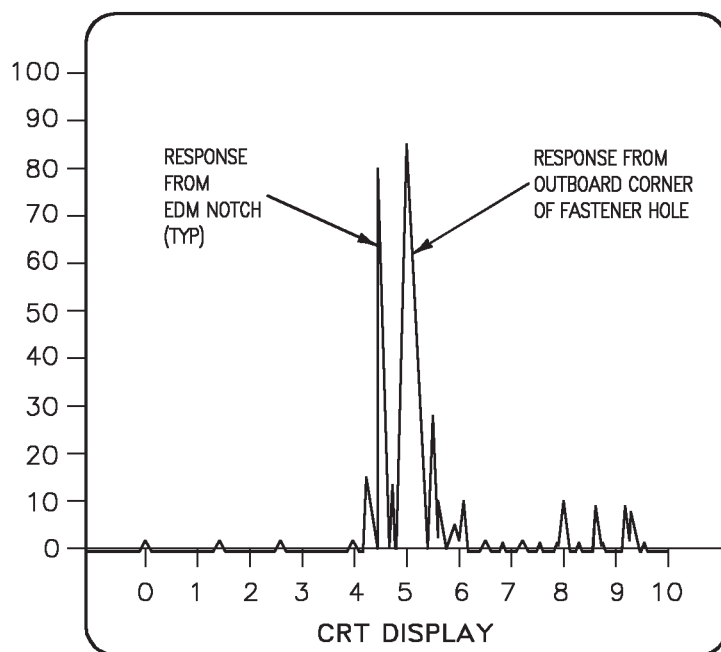


CRT 2

Figure 4. Determination of Initial CRT Response



CRT 1



CRT 2

Figure 5. CRT Response From Reference Standard



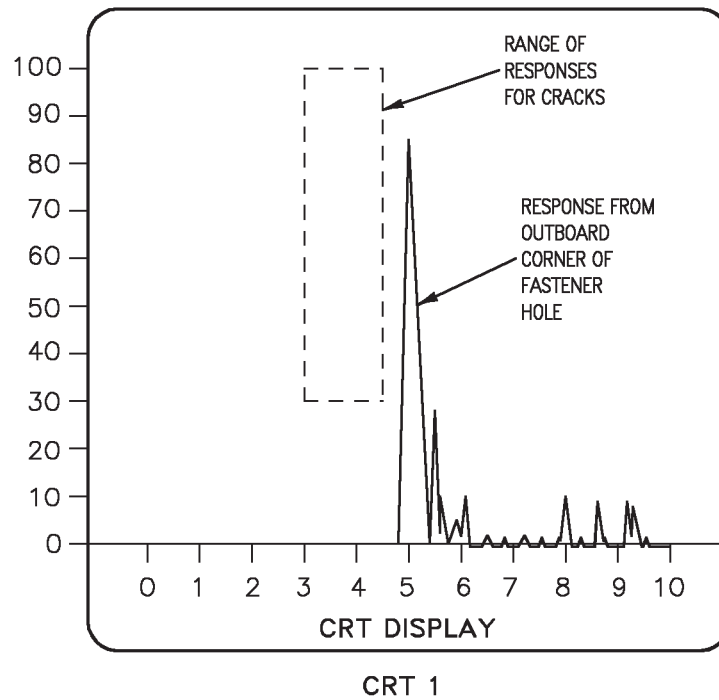


Figure 6. CRT Response From Former Stubs

# F/A-18

## VERTICAL TAIL FORMER STUB FLANGE FRETTING CRACK INSPECTION

SQUADRON \_\_\_\_\_

MODEL NO. \_\_\_\_\_

BUREAU NO. \_\_\_\_\_

MCAIR CUM NO. \_\_\_\_\_

FLIGHT HOURS \_\_\_\_\_

MODE 1 FLIGHT HOURS \_\_\_\_\_  
(TO BE CALCULATED BY MCAIR-STL)

LOCATION

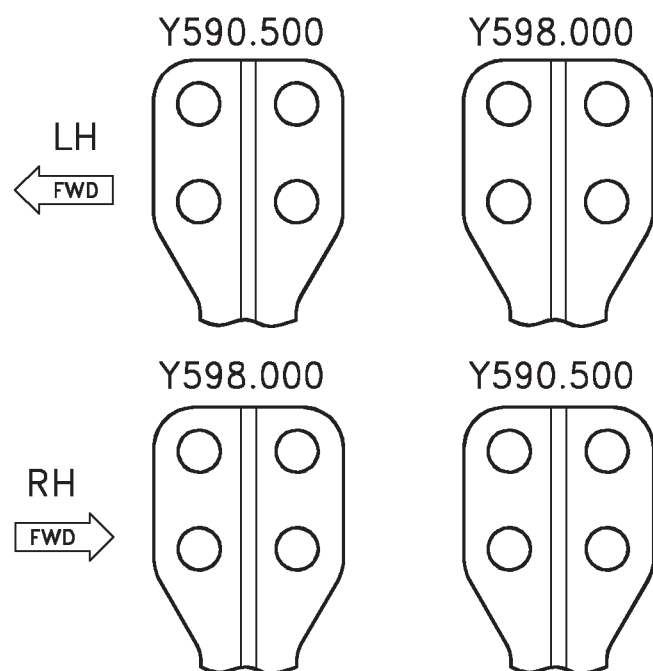
- ☐ BEAUFORT  
☐ CECIL FIELD  
☐ CHINA LAKE  
☐ EL TORO  
☐ JACKSONVILLE  
☐ LEMOORE  
☐ NELLIS  
☐ NORTH ISLAND  
☐ PATUXENT RIVER  
☐ POINT MUGU  
☐ YUMA  
☐ OTHER \_\_\_\_\_

## INSPECTION RESULTS

- ☐ NO FRETTING CRACKS OBSERVED ON ANY OF THE FORMER STUB FLANGES  
☐ FRETTING CRACKS OBSERVED ON THE FOLLOWING FORMER STUB FLANGES

## REPLACED FORMERS

(TO BE COMPLETED BY MCAIR-STL)

 THE FOLLOWING FORMERS WERE  
 REPLACED DURING THE ORIGINAL  
 MOD AT THE FLT HRS NOTED:

☐ Y590.500 LH      ☐ Y590.500 RH

\_\_\_\_\_ FLT HRS \_\_\_\_\_

☐ Y598.000 LH      ☐ Y598.000 RH

\_\_\_\_\_ FLT HRS \_\_\_\_\_

INSPECTION DATE

INSPECTOR

Figure 7. Inspection Results Documentation

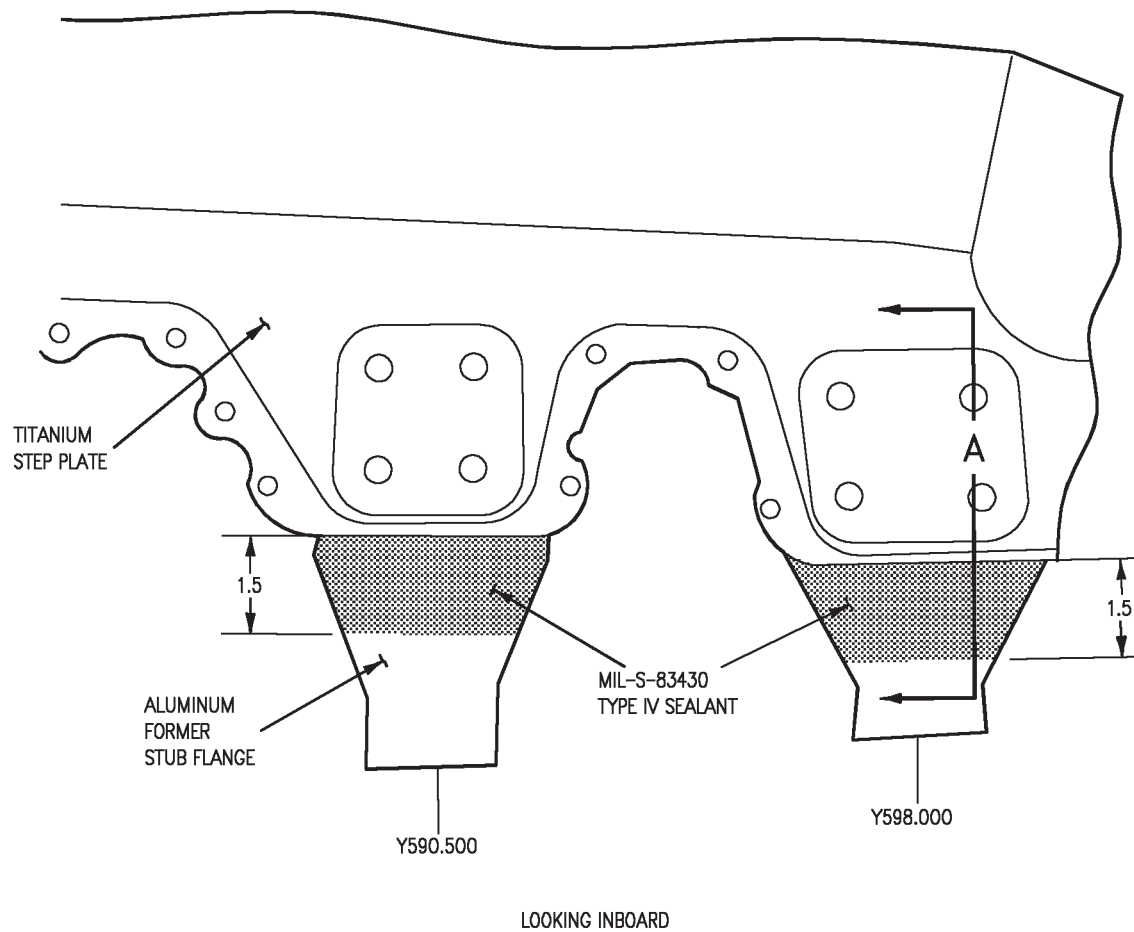


Figure 8. Sealant Buildup Area (Sheet 1)

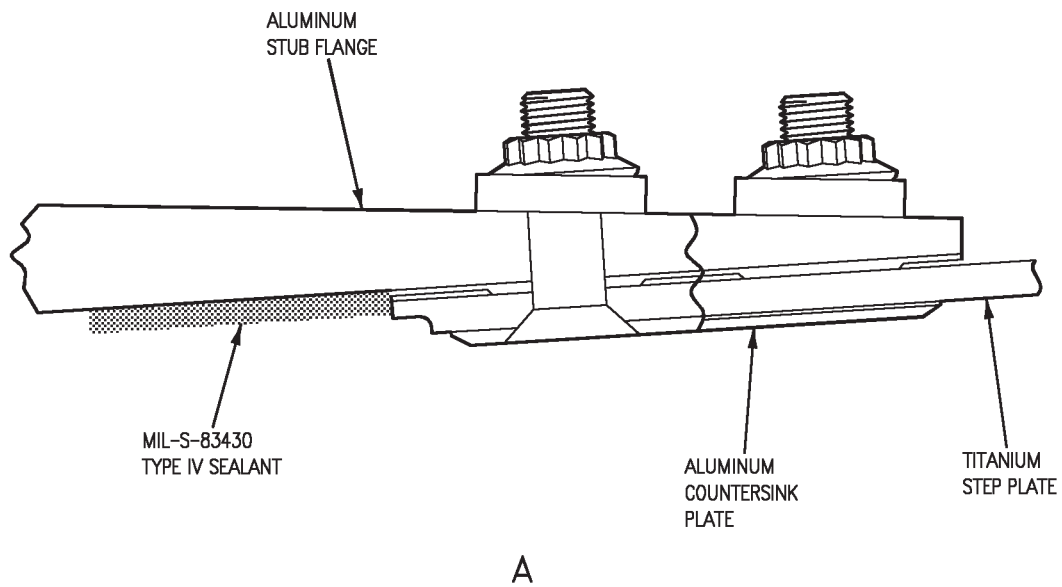


Figure 8. Sealant Buildup Area (Sheet 2)

## INTERMEDIATE AND DEPOT MAINTENANCE

## NONDESTRUCTIVE INSPECTION

## VERTICAL STABILIZER SPARS AND RIBS FASTENER HOLE RADIOGRAPHIC INSPECTION

PART NO. 74A230200

EFFECTIVITY: 161353 THRU 163175

## Reference Material

Naval Aviation Maintenance Program .....	OPNAVINST 4790.2
Nondestructive Inspection Methods .....	NAVAIR 01-1A-16
Nondestructive Inspection.....	A1-F18AC-SRM-300
Radiographic Method.....	WP005 00

## Alphabetical Index

Subject	Page No.
Vertical Stabilizer .....	1
Defects .....	1
Primary Inspection Method .....	2
Access.....	2
Documentation .....	4
Equipment Settings/Standardization/Setup .....	2
Interpretation .....	4
Inspection Procedure.....	3
Personnel Qualifications .....	2

## Record of Applicable Technical Directives

Type/ Number	Date	Title and ECP No.	Date Incorp.	Remarks
F/A-18 AFB 140 Rev. A	Jan 1992	Radiographic Inspection of Vertical Stabi- lizer	15 Dec 92	-

## 1. VERTICAL STABILIZER.

2. Vertical stabilizer is made from graphite epoxy laminate skins and 7075 aluminum spars and ribs. The 62.5 percent spar, P/N 74A230726, and 77.5 percent spar, 74A230728, are machined 7075 aluminum bars heat treated to T73511. The P/N 74A230738, rib is machined from 7075 aluminum

plate and heat treated to T7351. Ribs and spars are finished with sulfuric acid anodize and two coats of epoxy primer. Surface finish is one coat epoxy primer and 2 coats polyurethane enamel.

3. **DEFECTS.** Inspect for cracks emanating from fastener holes and/or scollops in spars or ribs.

4. **PRIMARY INSPECTION METHOD.** Primary inspection method is radiographic.

5. **Personnel Qualifications.** Personnel doing this nondestructive inspection should be qualified and certified to do radiographic inspections per OPNAVINST 4790.2 SERIES, NDI Technicians, NEC 7225/MOS 6044.

### Support Equipment Required

#### NOTE

Alternate item type designations or part numbers are listed in parentheses.

Part Number or Type Designation	Nomenclature
1667AS100 (GXR7-6B)	X-ray Apparatus, Portable
072-1500 (1635AS100-1)	X-ray Film Processor
314X	Film Identification Set
65C559-1	Tube Head Stand
46-122561G1 (65C1)	X-Ray Film Illuminator
Make See Figure 3 MY39840	Alignment Indicator Protractor, Sears Craftsman
301	Densitometer
— (52-665-005)	7X—14X magnifier Optical Comparator, 7X Scale Magnifier, Fowler

### Materials Required

#### NOTE

Alternate item specifications or part numbers are shown indented.

Specification or Part Number	Nomenclature
179-6531	Industrex M/AA Ready Pak Duo, 14X17
145-8926	X-ray Film M-2 Ready Pack, 14X17, Kodak

### Materials Required (Continued)

#### NOTE

Alternate item specifications or part numbers are shown indented.

Specification or Part Number	Nomenclature
145-9205, Type NDT 55	X-ray Film, AA-2 Ready Pack, 14X17, Kodak
807699, Type NDT 75	X-ray Film, Daypack, 14X17 Dupont Cronex
807850, Type NDT 75	X-Ray Film, Daypack, 14X17 Dupont Cronex
MIL-P-83953-2, TYPE 1, CLASS A or B, RED or BLACK	Aircraft Marking Pencil
A-A-883, TYPE 1	Pressure Sensitive Tape

6. **Preparation of Aircraft.** No special preparation required.

7. **Access.** Two B4A workstands, (workstands) or equivalent are required, see figure 1. First workstand used as platform for X-ray tube head stand for shooting film. Second workstand will be located near aft fuselage and will be used by person (s) assisting in determining aiming point and alignment. Also personnel will be required to work on top of aft fuselage to tape X-ray film to inboard side of vertical stabilizer.

8. **Preparation of Part.** No special preparation required.

### WARNING

#### HIGH RADIATION

Make sure applicable safety precautions in WP005 00 and NAVAIR 01-1A-16 are complied with. Failure to comply may result in injury to personnel.

#### 9. Equipment Settings/Standardization/Setup.

a. Set X-ray unit per data contained in technique chart, see figure 1.

b. Position tube head stand on workstand with legs spread open.

c. Locate workstand so center of tube head stand is approximately 108 +5/-1 inches from outboard vertical stabilizer skin.

d. Attach tube head to tube head stand.

e. Position protractor on top of tube head.

f. Rotate tube head to 20 degree angle from horizontal.

g. Use flashlight, string, or long straight edge between tube head window and vertical stabilizer skin to determine aiming point and alignment.

h. After alignment, verify distance from tube head window to aiming point on outboard skin of vertical stabilizer, 108 +5/-1 inches. If not at desired distance readjust tube head stand to get correct source to object distance.

i. Alternate setups may be used to inspect questionable areas found on initial shot. However, each different setup used must be recorded. Any deviation in kV, mA, exposure time, film type, source-to-object distance, film location, aiming point, or angle of central ray in reference to vertical stabilizer skin shall be recorded. New technique shall be identified in film nomenclature.

#### 10. Inspection Procedure.

##### NOTE

When using readypack film with both M and AA film, position M film side closer to X-ray source.

a. Tape 1 piece of M film in position shown in figure 2 for shot one.

b. Tape 1 piece of AA film over M film in position.

c. Prepare film nomenclature. Nomenclature should include;

(1) Aircraft bureau number.

(2) Film number.

(3) L/H or R/H.

(4) Date.

(5) Name of inspector.

d. Attach film nomenclature to inboard side of vertical stabilizer skin between two spars and between M film and inboard skin.

e. Lead tape arrows shall be positioned at edge of one fastener head, three holes above and three holes below aiming point, on outboard side of vertical stabilizer skin. Lead letter 'S' should be positioned near each arrow to assist interpreter in determining spar flange on source side.

f. Make alignment indicator per figure 3.

g. Attach alignment indicator to outboard side of vertical stabilizer, between two spars, with masking tape so it will appear in either top or bottom corner of film. Be sure position of alignment indicator does not interfere with film nomenclature.

h. Add masking tape, as required, to eliminate film movement caused by air movement.

##### WARNING

##### HIGH RADIATION

Make sure applicable safety precautions in WP005 00 and NAVAIR 01-1A-16 are complied with. Failure to comply may result in injury to personnel.

i. Expose film per technique chart, see figure 1.

j. Remove film from vertical stabilizer.

k. Run one piece of unexposed film through film processor before exposed film. Continue running pieces of unexposed film until one is viewed without transfer shoe lines, scratches, or any other type of lines or dots.

l. Develop exposed film.

m. Repeat steps in paragraphs 6 through 10 for each location to be radiographed on both left and right vertical stabilizer.

## 11. Interpretation.

### NOTE

If adjustments to mA or exposure time do not bring film density into correct range, inspect to see if chemicals in developer are spent.

a. Zero out 301 densitometer. Test density of exposed film with densitometer. Film density should be in range of 1.9 through 3.2 H and D units for M film. Density of AA film may be out of this range. If AA film is not in this range adjust mA or exposure time, as required. Document any changes and keep new parameters with film.

b. Interpretation room shall have lights dimmed or turned off during viewing of film. Use X-ray film illuminator for all interpretation.

c. Examine alignment indicator imaged on corner of film, both vertical and horizontal lines should be visible. If not, reshoot area using several shots with smaller pieces of film. Record tube alignment, film location, and any parameter changes for any reshoots and keep documentation with film.

d. Film should have initial interpretation at magnification of 1 X. Second shall be done at magnification between 7 X and 15 X.

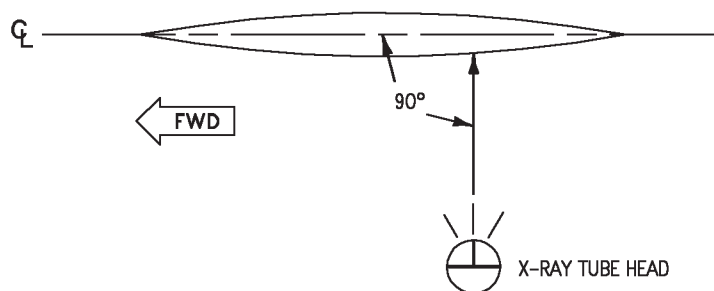
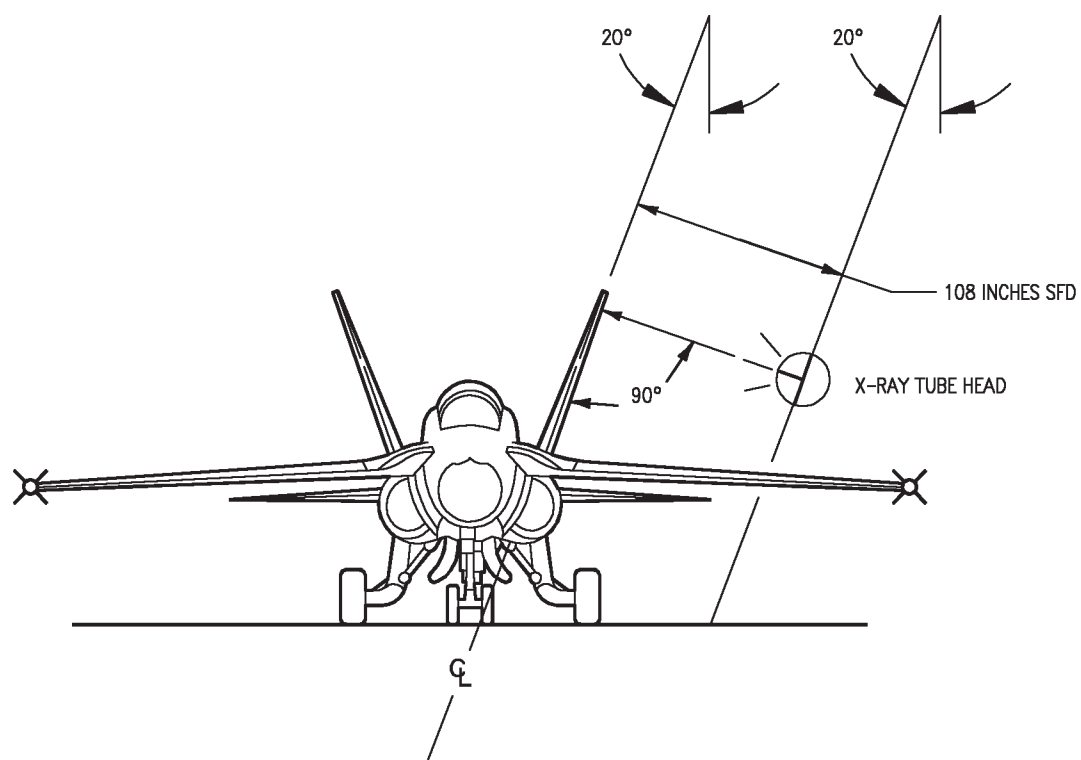
e. Mark all linear indications observed on film. Use AA film to verify indications on M film are not scratches or film anomalies. If unsure indication is a crack, compare it to reference radiograph and / or to any previous film history for that location on aircraft. Reshoots may be made at different angles utilizing different parameters, as required, to aid interpretation.

f. Record parameters and any changes in alignment. Keep copy of revised technique with exposed film after developing.

g. If spars or ribs are obscured by fastener debris, area shall be considered uninterpretable. If spars are obscured by sealant that was injected to immobilize dump tube in previous AFB / AFC, area shall be considered uninterpretable. Areas most likely to be affected by this is shown in figure 2, sheets 2 and 6.

12. **Documentation.** Construct sketch of each crack found during interpretation. Fastener number, crack length, crack direction, film number, shot number, bureau number, flight hours, date, inspector, and inspection must be recorded and retained.





TOP VIEW OF  
VERTICAL  
STABILIZER

Figure 1. Equipment Setup (Sheet 1)

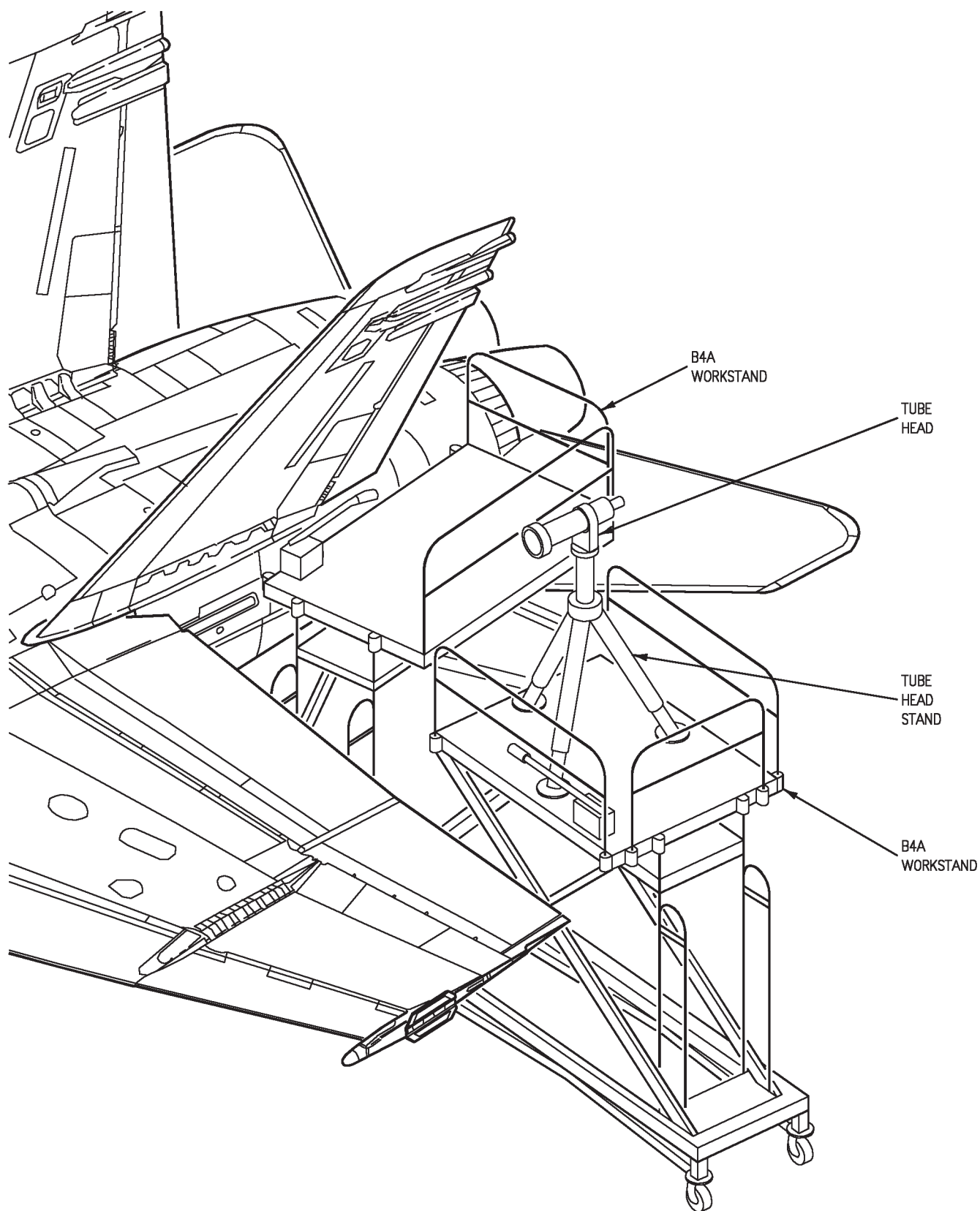




Figure 1. Equipment Setup (Sheet 2)

TECHNIQUE CHART								
SHOT	FILM NUMBER	SFD INCHES	ANGLE	 FILM TYPE	mA	kVP	TIME (SEC.)	 DENSITY
1	1	108 +5/-1	90	AA AND M	5	115	210	M FILM 1.9-3.2
2	2	108 +5/-1	90	AA AND M	5	115	210	M FILM 1.9-3.2
3	3	108 +5/-1	90	AA AND M	5	115	120	M FILM 1.9-3.2

## LEGEND

 H AND D DENSITY UNITS.

 USE CUT AND BAGGED 14 X 17 INCH FILM.

Figure 1. Equipment Setup (Sheet 3)

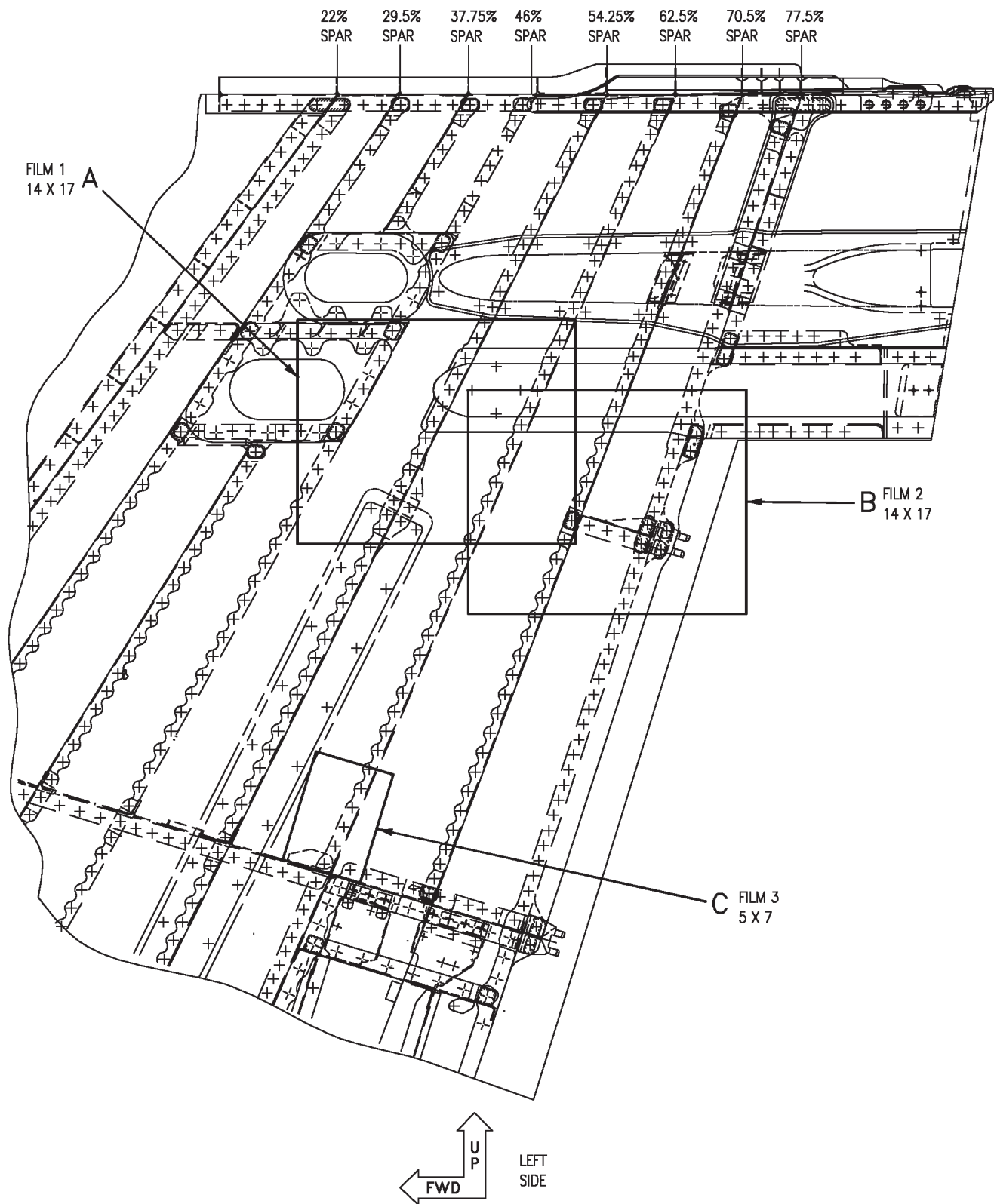


Figure 2. Film Layout and Aiming Points (Sheet 1)

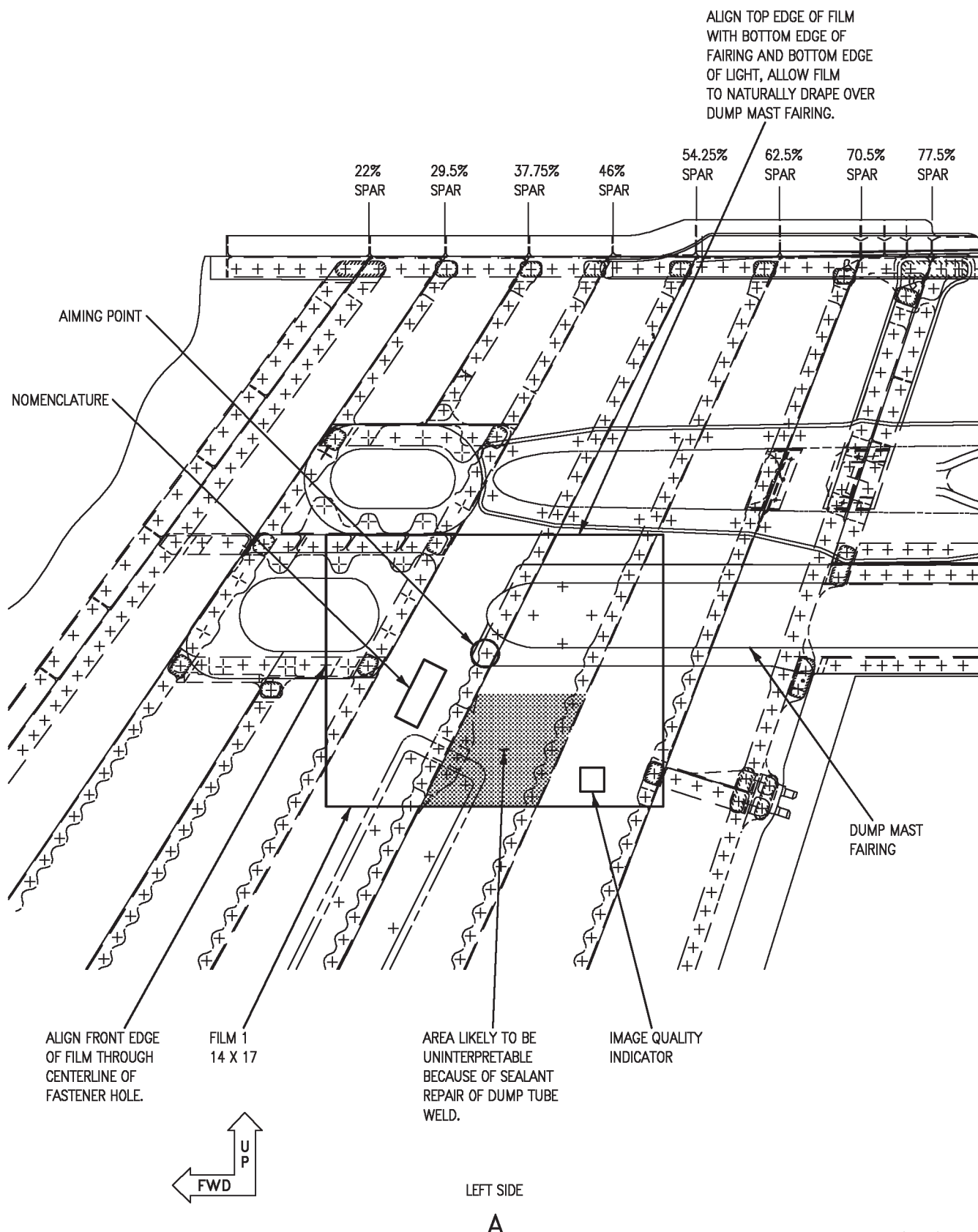
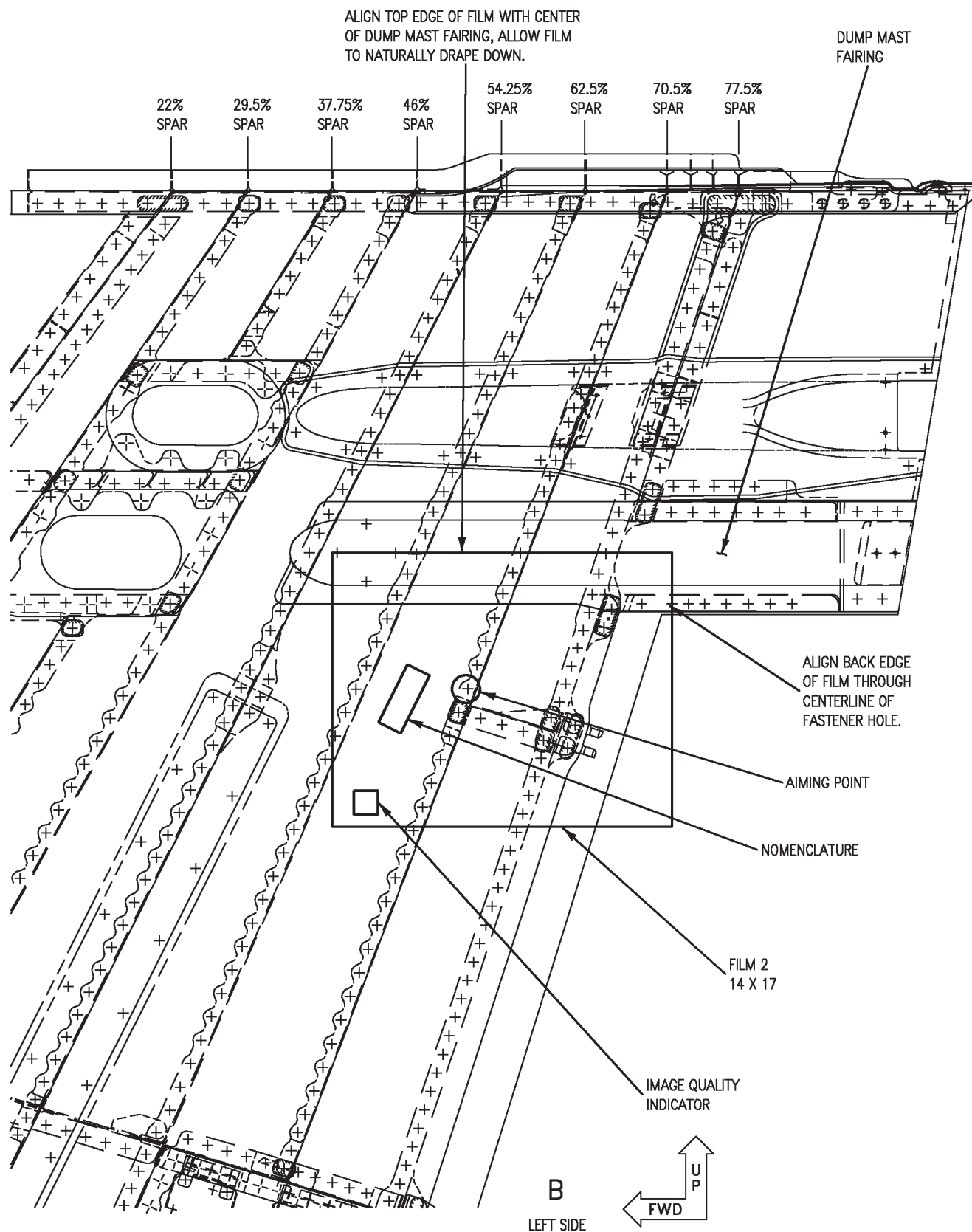


Figure 2. Film Layout and Aiming Points (Sheet 2)



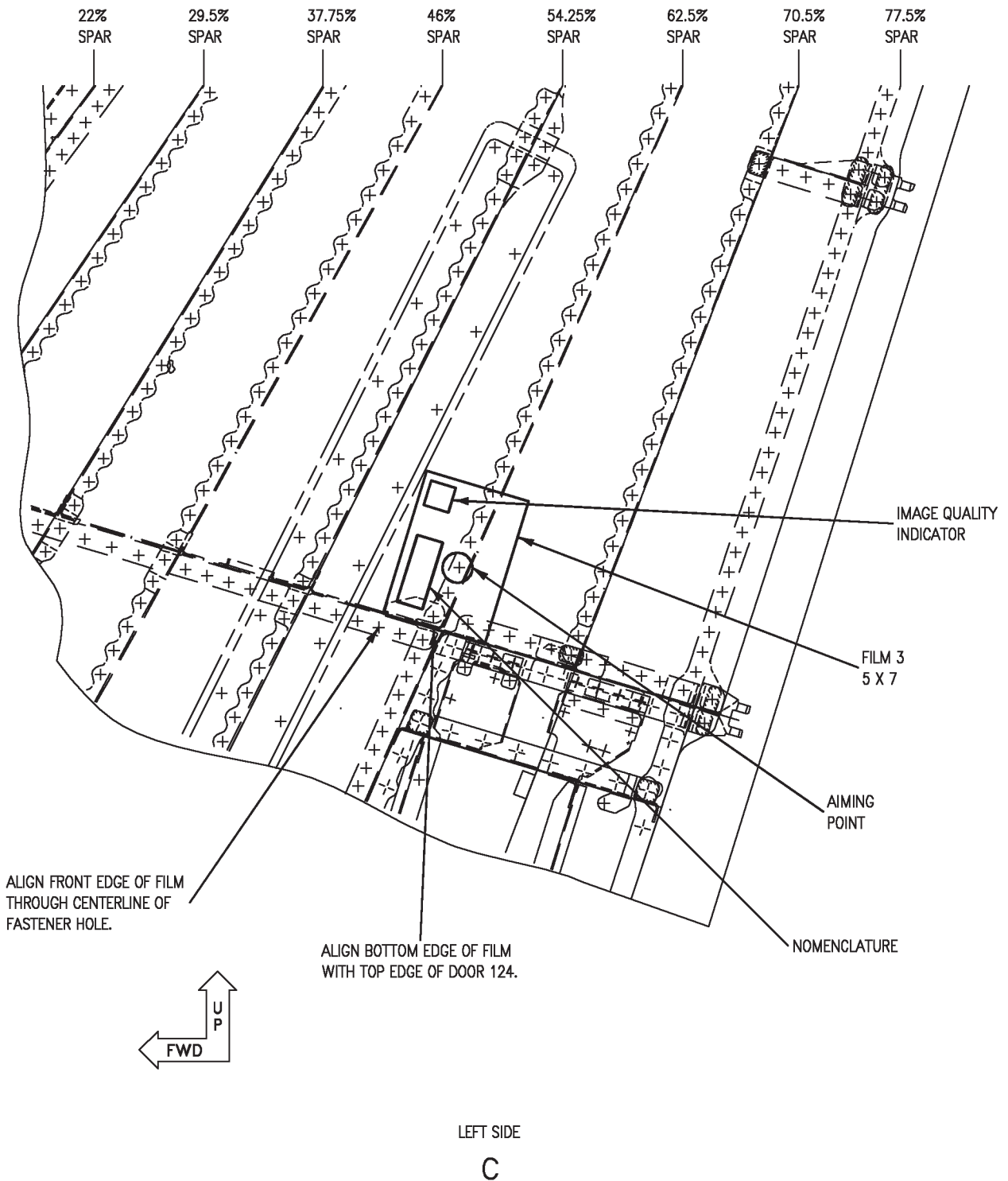


Figure 2. Film Layout and Aiming Points (Sheet 4)

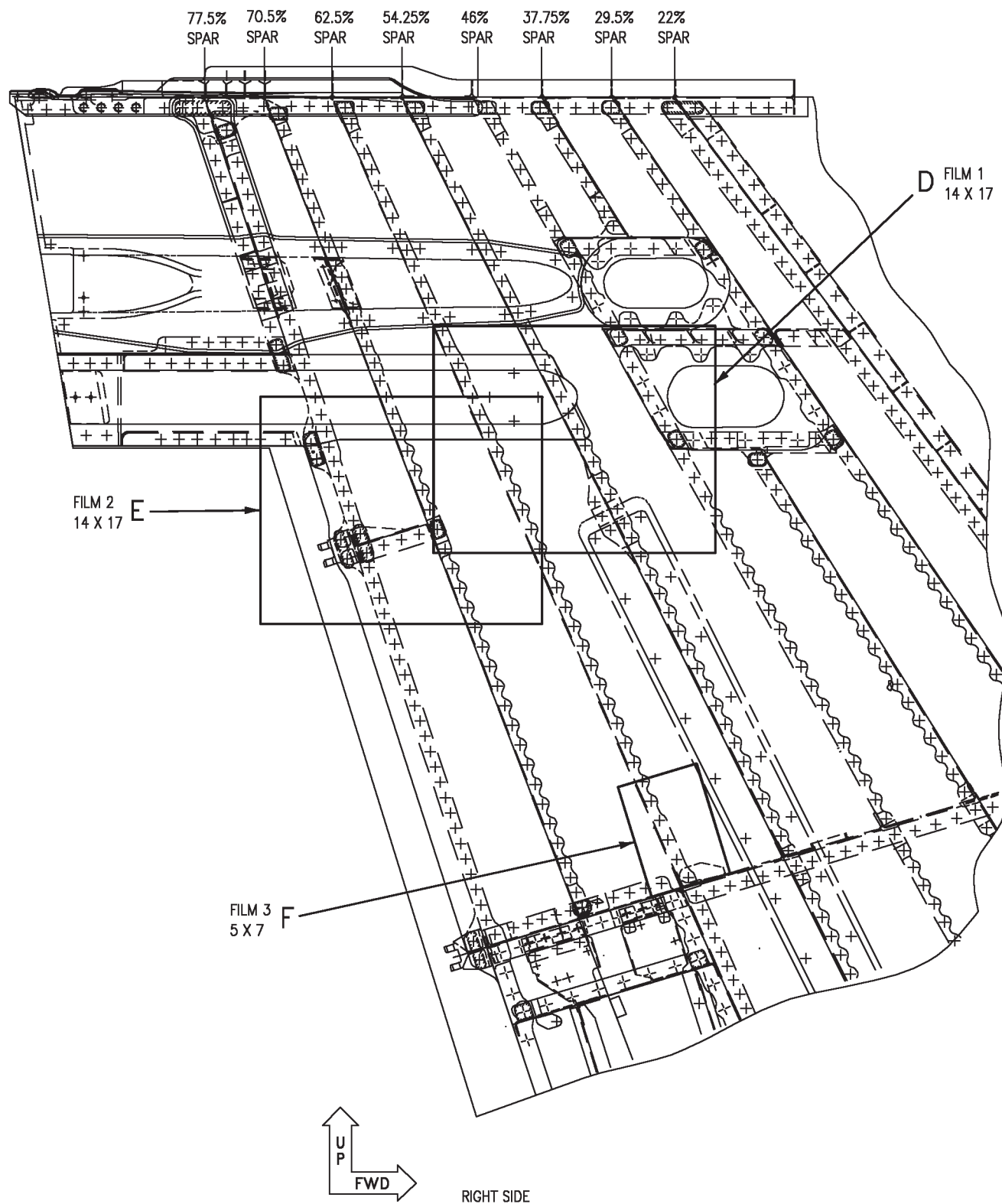


Figure 2. Film Layout and Aiming Points (Sheet 5)



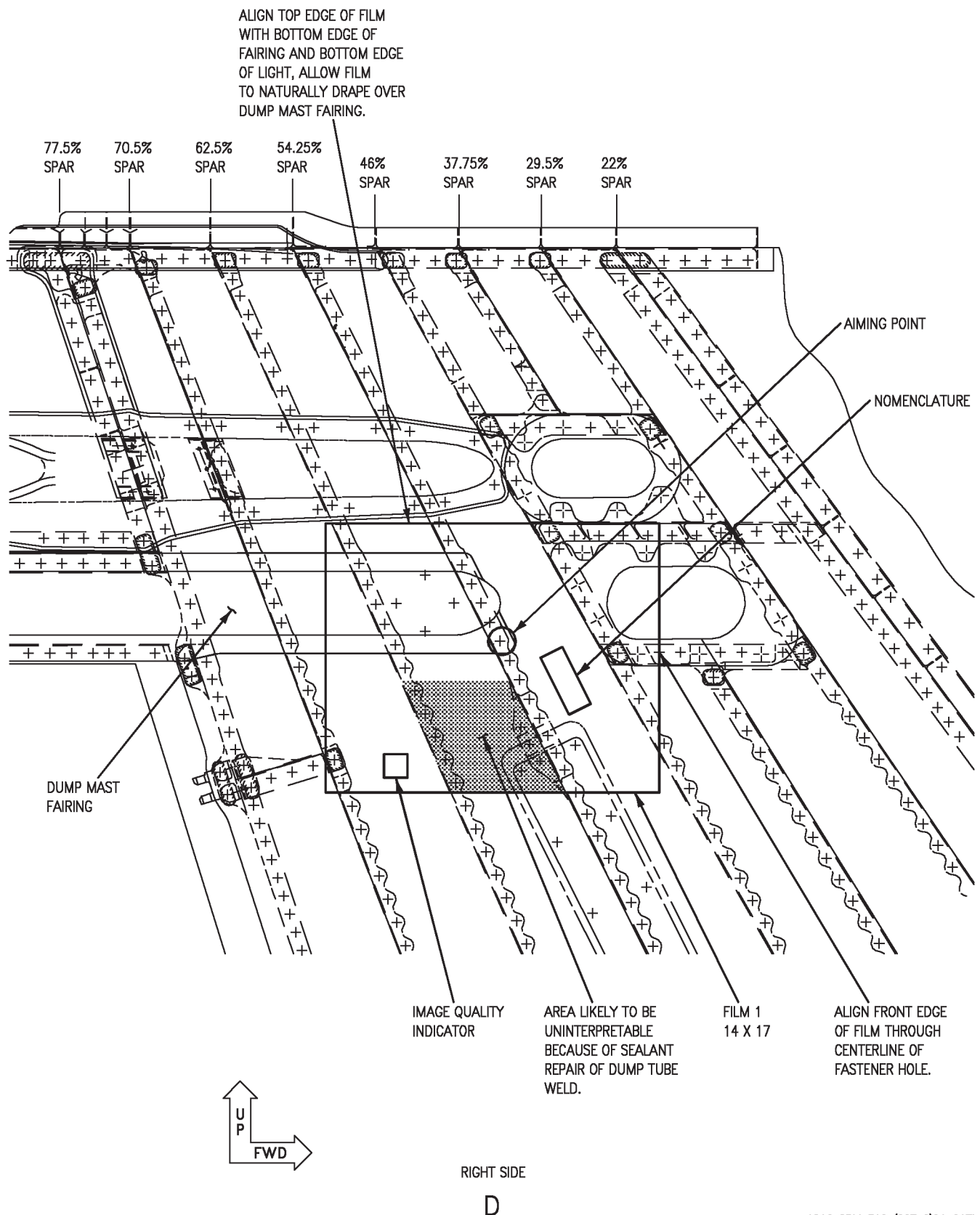


Figure 2. Film Layout and Aiming Points (Sheet 6)

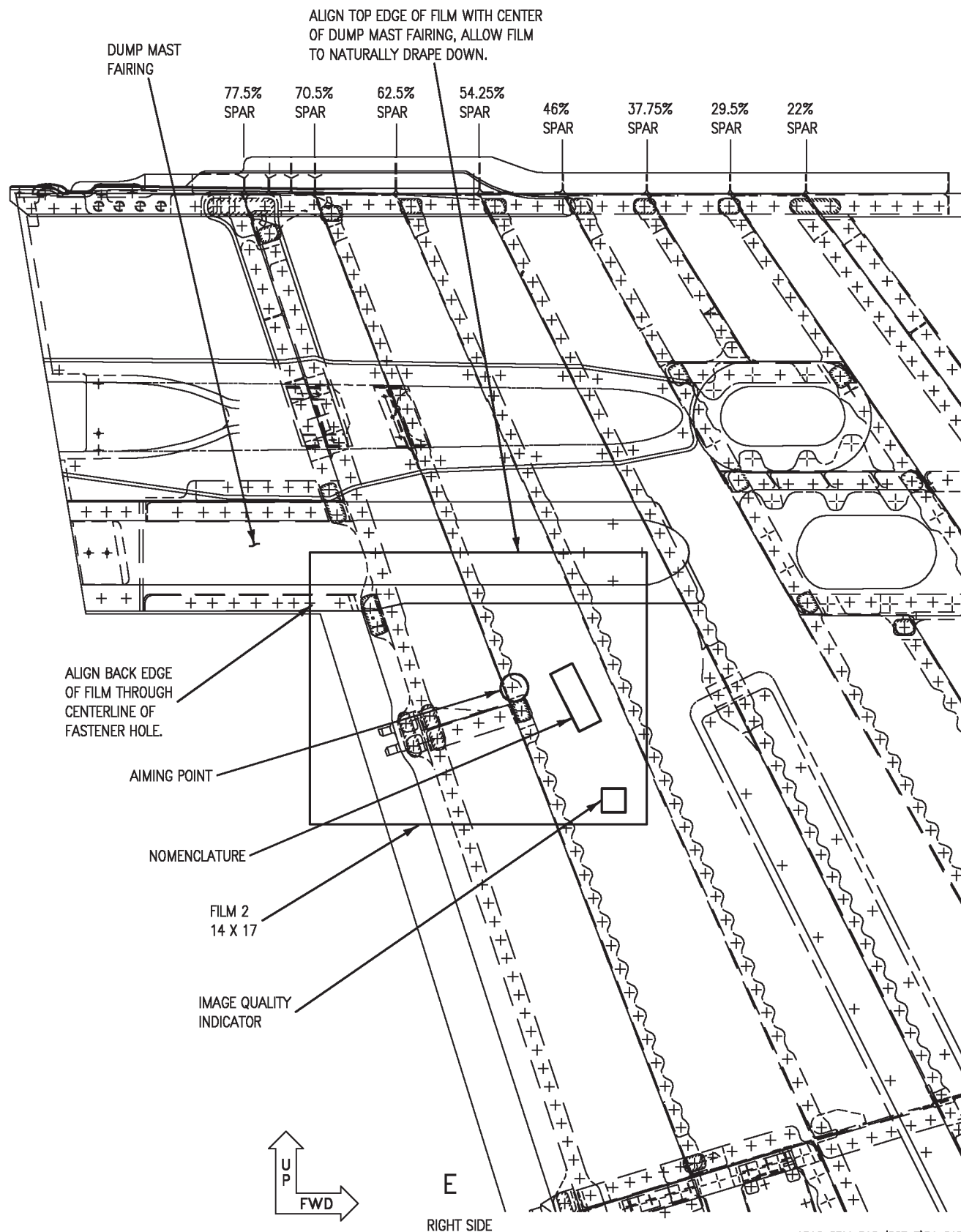


Figure 2. Film Layout and Aiming Points (Sheet 7)

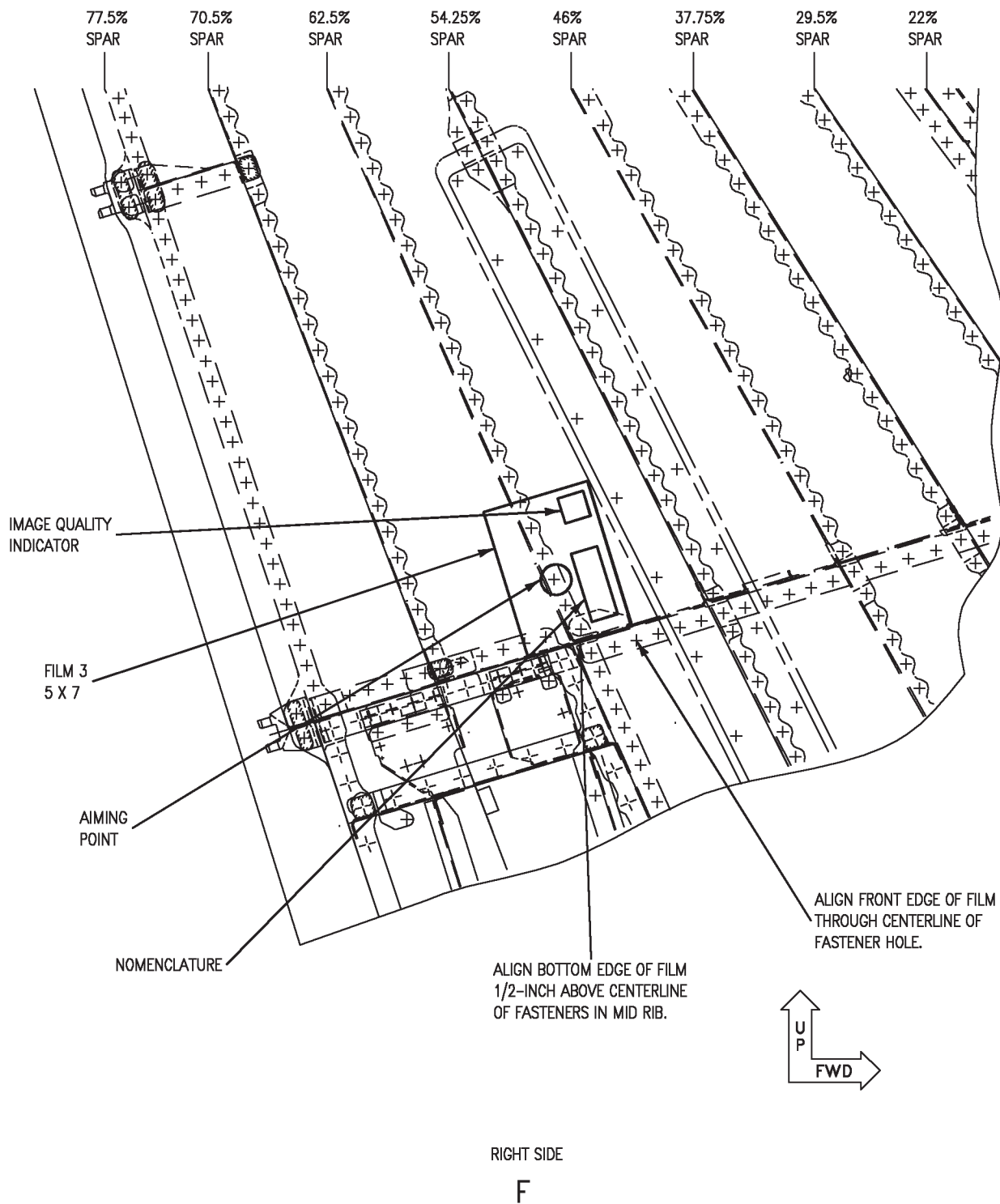
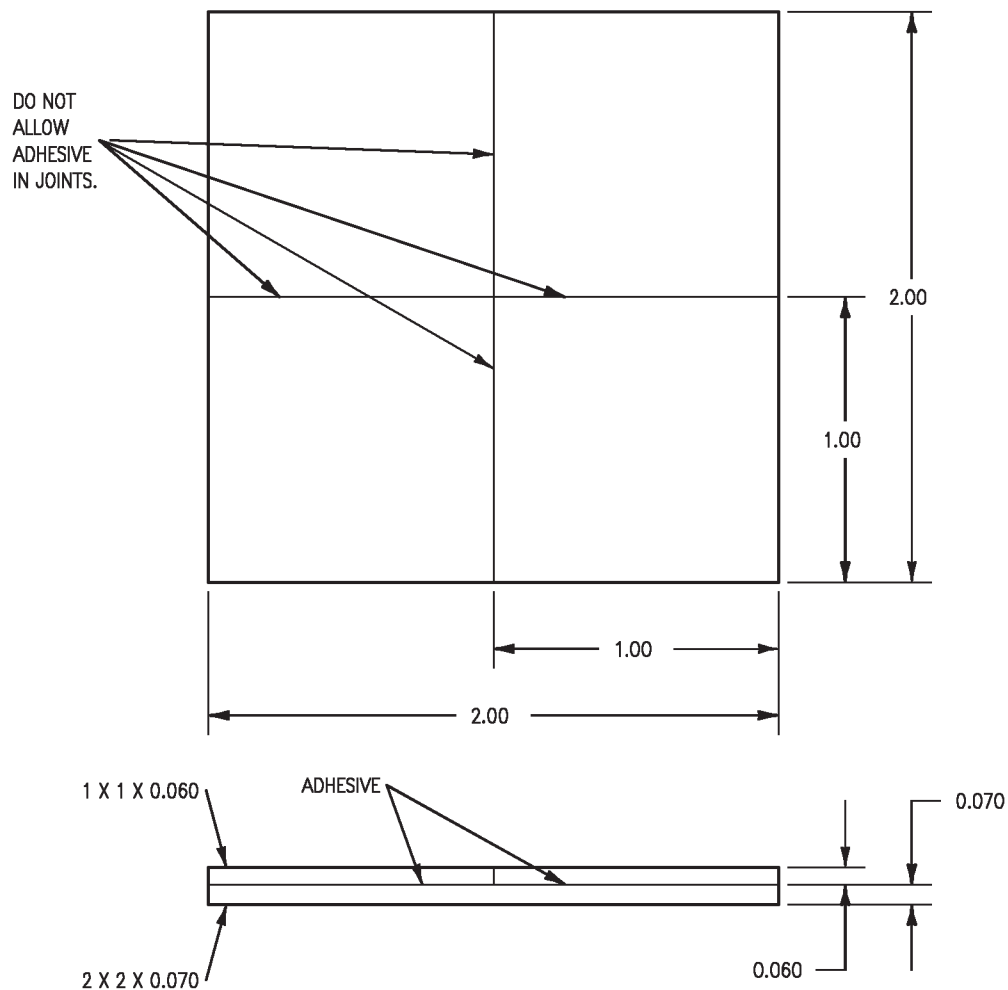


Figure 2. Film Layout and Aiming Points (Sheet 8)



### LEGEND

1. ALL DIMENSIONS SHOWN IN INCHES.
2. PART NO. 74JSB2579-1001.
3. MATERIAL: 7075 ALUMINUM, ANY TEMPER.
4. DIMENSIONS: INCHES  $\pm 0.010$  UNLESS OTHERWISE SPECIFIED.
5. SURFACES: 125 RHR OR BETTER.
6. TOP AND SIDE VIEWS SHOW FOUR 1 IN. BY 1 IN. PIECES NESTED TIGHTLY TOGETHER AND BONDED TO 2 IN. BY 2 IN. PIECE OF ALUMINUM, ANY TEMPER.
7. BOND THE FOUR 1 IN. BY 1 IN. PIECES TO 2 IN. BY 2 IN. PIECE AS SHOWN. USE EASTMAN 910 ADHESIVE OR SUPER GLUE. DO NOT ALLOW ADHESIVE TO SEEP BETWEEN THE 1 IN. BY 1 IN. PIECES. DESIRABLE CONDITION IS EDGE TO EDGE CONTACT OF THE 1 IN. BY 1 IN. PIECES, WITHOUT ANY ADHESIVE BETWEEN EDGES.

**Figure 3. Alignment Indicator**

## INTERMEDIATE AND DEPOT MAINTENANCE

## NONDESTRUCTIVE INSPECTION

## VERTICAL STABILIZER SPARS AND RIBS FASTENER HOLE EDDY CURRENT INSPECTION

PART NO. 74A230200

EFFECTIVITY: 161353 THRU 163175

This WP supersedes WP060 01, dated 15 December 1992.

## Reference Material

Naval Aviation Maintenance Program ..... OPNAVINST 4790.2  
 Line Maintenance Access Doors ..... A1-F18AC-LMM-010

## Alphabetical Index

Subject	Page No.
Vertical Stabilizer .....	1
Defects .....	1
Primary Inspection Method .....	2
Access.....	2
Documentation .....	4
Equipment Settings/Standardization/Setup.....	2
Interpretation .....	4
Inspection Procedure.....	3
Personnel Qualifications .....	2
Preparation of Aircraft.....	2
Preparation of Part.....	2

## Record of Applicable Technical Directives

Type/ Number	Date	Title and ECP No.	Date Incorp.	Remarks
F/A-18 AFB 140 Rev. A	Jan 1992	Radiographic Inspection of Vertical Stabi- lizer	15 Dec 92	-

## 1. VERTICAL STABILIZER.

2. Vertical stabilizer is made from graphite epoxy laminate skins and aluminum spars and ribs. The 74A230726 62.57 percent spar and 74A230728 77.5 percent spar are machined 7075 aluminum bars heat treated to T73511. The 74A230738 rib is machined from 7075 aluminum plate and heat treated to

T7351. Ribs and spars are finished with sulfuric acid anodize and two coats of epoxy primer. Skin surface finish is one coat epoxy primer and 2 coats polyurethane enamel.

3. DEFECTS. Inspect for cracks emanating from fastener holes and/or scallops in spars or ribs.

4. **PRIMARY INSPECTION METHOD.** Primary inspection method is eddy current.

5. **Personnel Qualifications.** Personnel doing this nondestructive inspection should be qualified and certified to do eddy current inspections per OPNAVINST 4790.2 SERIES, NDI Technicians, NEC 7225/MOS 6044.

### Support Equipment Required

#### NOTE

Alternate item type designations or part numbers are listed in parentheses.

Part Number or Type Designation	Nomenclature
NDT-25N (MXU-713/E) NRK-3AST	Programmable Eddy Scope, Nortec Navy Reference Standard Kit
9505955 GPK-36 MP905-50	Accessory Kit Navy Probe Set F.S., 90 Degree, 200 kHz, 6 Inches Long, 1/2 Inch Drop, 1/8 Inch Dia.
CBM-6 or EQUIVALENT	Microdot to BNC Connecting Cable, 2 Req'd.
NRK-3AL or EQUIVALENT	Aluminum Notched Reference Standard

### Materials Required

#### NOTE

Alternate item part numbers are shown indented.

Specification or Part Number	Nomenclature
020X413 CCCC46TY1CL4 COMMERCIAL Make, Figure 3	Cleaning Compound Cloth, Cleaning 0.25 Dia., Hole Plug, Make From Aluminum or non-metallic Material
AA883TYPE1-0-500IN	Tape, Pressure Sensitive

### Materials Required (Continued)

#### NOTE

Alternate item part numbers are shown indented.

Specification or Part Number	Nomenclature
LP513TYPBGO-875	Plastic Scrapper, Made From Plastic Sheet
MS20470AD8-12	Solid Rivet
MS20426AD8-12	Solid Rivet

6. **Preparation of Aircraft.** No special preparation required.

7. **Access.** Have doors 100 L/R and 124 L/R removed (A1-F18AC-LMM-010).

8. **Preparation of Part.** Use plastic scrapper to remove form-in-place seal, gray polysulfide sealant, from flange of each spar and rib inspection area.

9. **Equipment Settings/Standardization/Setup.**

#### NOTE

Any impedance plane eddy current equipment may be used for this procedure with any probe, provided equipment and probe are standardized similar to paragraph 9. In addition, alternate ferrite shielded probes may be used with NDT-25N eddy scope provided they are standardized identical to paragraph 9. Exact eddy scope settings may vary.

Reference standard is considered equivalent for surface inspection, if it is made of same material and contains two EDM notches between 0.008 and 0.020 deep.

a. Attach ADN-B1 adapter, which is part of accessory kit to NDT-25N programmable eddy scope.

b. Attach two connecting cables to adapter.

c. Attach MP905-50 probe, part of the GPK-36 Navy probe set, to connecting cable on front of

adapter and other probe to connecting cable on side of adapter. Probe connected to side of adapter is used as reflective coil and must be kept away from electrically conductive material.

- d. Set eddy scope front face settings;

POWER .....	ON
STATUS LIGHTS .....	ON
GAIN .....	30
FREQ.....	200
FILTER.....	0
H SENS.....	0.5
V. SENS.....	0.2
DISPLAY.....	H/V
I/O SWITCHES.....	OFF
ALARM.....	OFF
NON-STORE .....	OFF

#### NOTE

Hole plug or rivet may be used as a guide to prevent eddy current probe from sliding into fastener hole during inspection. Hole plug or rivet eliminates edge effect signals on CRT, see figures 2 and 3.

- e. Insert hole plug, MS20470AD8-12 or MS20426AD8-12 rivet into hole to be inspected on NRK-3AL reference standard, which is part of the NRK-3AST Navy reference standard kit.

#### NOTE

Hole plug shall be used except when holes have bushings installed. Other dash number rivet may be used, length is not important. A 1/4 dia. aluminum bolt may be substituted, but head must be machined to dia. of 0.37.

If suitable fastener is not available, contact NADEP NORIS logistics to get probe guide.

- f. Position probe against plug or head of rivet so probe sensor is in contact with reference standard.

- g. Press NULL and ERASE buttons.

- h. Press POS button and directional buttons, as indicated by triangular arrow on button, until dot is centered on CRT.

- i. Press ERASE button, see figure 2, CRT 1.

#### NOTE

On following steps, press ERASE button as required.

- j. Adjust ANGLE, as required, to receive trace on CRT similar to trace shown on figure 2, CRT 2, as probe is lifted off surface of reference standard.

- k. Scan probe over EDM notches. Traces should appear on CRT similar to those on figure 2, CRT 3. If traces are not similar, adjust GAIN until traces are similar. Press NULL after any changes to GAIN.

#### 10. Inspection Procedure.

- a. Visually inspect circumference of fastener holes in rib and spar flanges shown in figure 1. Identify any cracks. Areas cracked may show increase of dirt or soot.

#### WARNING

Cleaning compound is flammable liquid and vapor. May cause allergic respiratory and skin reaction. May cause eye, skin and respiratory irritation. Keep away from heat, sparks, and flame. Do not breathe dust (vapor, mist, gas). Use only with adequate ventilation. Keep container closed. Avoid contact with eyes, skin and clothing. Wash thoroughly after handling.

- b. Clean inspection area of any contamination or foreign material using cleaning cloth moistened with cleaning compound. Allow surface to air dry 15 minutes.

- c. Mask any openings large enough for hole plug or MS20470AD8-12 rivet to slide in and not be easily retrieved using pressure sensitive tape.

- d. Insert hole plug or rivet into hole to be inspected, see figure 3.



e. Position probe against hole plug or head of rivet so probe sensor is in contact with part to be inspected.

f. Press NULL and ERASE buttons, CRT should appear as shown in figure 2, CRT 2.

g. Lift probe off part to determine lift-off direction.

h. Adjust ANGLE, as required, to get lift-off travel from center of CRT to left as shown in figure 2, CRT 2.

## NOTE

Lift-off will always produce traces left. Tapered section, becoming thinner during scanning will always display downward trace on CRT.

i. Press ERASE, as required, to keep CRT pattern similar to CRT presentation shown on figure 2, CRT 3 during scanning. It is acceptable for dot on CRT to travel along lift-off line as long as it remains within 2 major divisions of center on CRT.

j. Rescan any area in which cursor has left CRT, being careful to maintain good contact between probe tip and work, and minimizing rocking of probe.

## 11. Interpretation.

a. Any traces on CRT that have separation angle from lift-off greater than notch depth on reference standard, see figure 2, CRT 3, shall be marked on part, provided indication is repeatable.

## NOTE

Due to variation in conductivity from part-to-part or reference standard-to-reference standard, trace direction may rotate slightly. Less conductive parts, than reference standard, will have traces rotated counter clockwise while more conductive parts will have traces rotated slightly clockwise from those traces shown in figure 2.

b. Determine length by scanning back and forth perpendicular to indication while indexing along centerline of indication.

c. Try to determine if rejected indication is caused by physical damage to part, pitting corrosion, or a crack, by doing any or all of following inspections:

(1) Visual inspection with magnification.

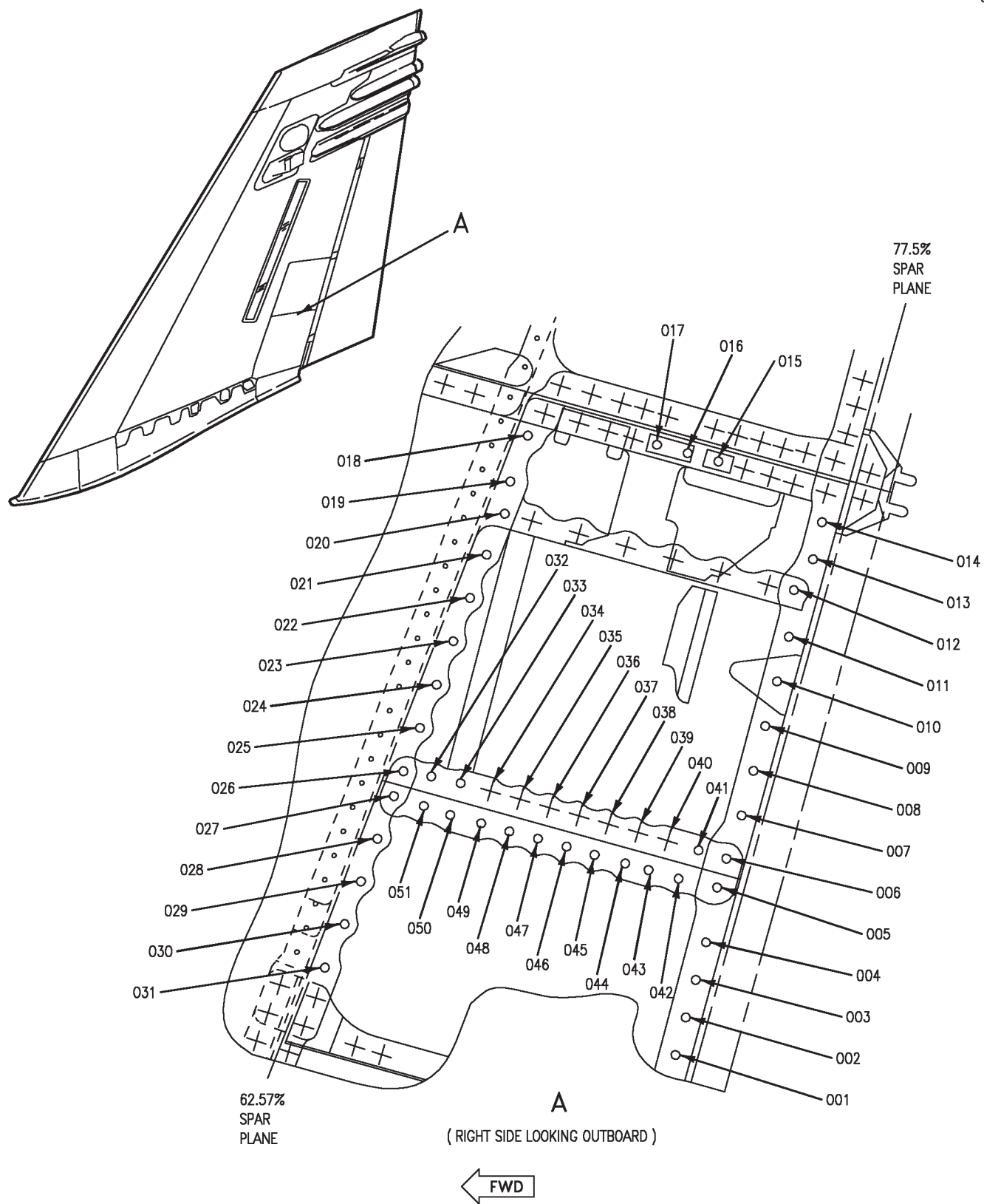
(2) Fluorescent penetrant inspection, after locally stripping paint, do not do pre-penetrant etch.

(3) Borescope inspection of I. D. of hole.

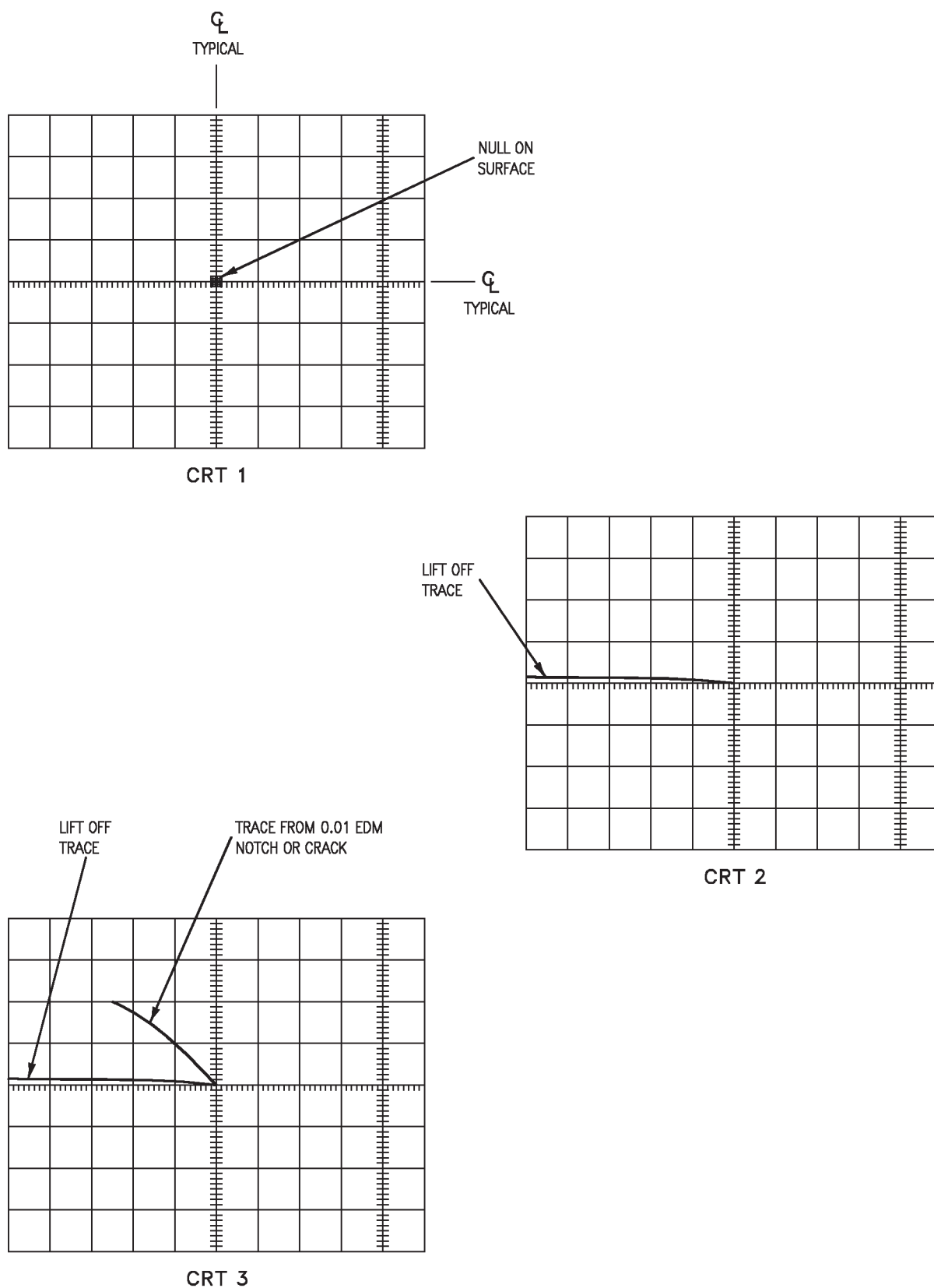
d. When determining crack length, ends of cracks will be determined when dot returns to center position on CRT. To verify end of crack, scan from good area into suspected end of crack, mark area on part where dot begins to raise from centerline.

12. **Documentation.** If cracks or corrosion are found, map location and provide dimensions on illustrations similar to documentation sheet, see figure 4. Include information such as aircraft bureau number, total flight hours, airframe bulletin, date of inspection, name of inspector. Submit to local engineering for disposition. File one copy of documentation sheet and engineering disposition for cracks or corrosion in aircraft log book.

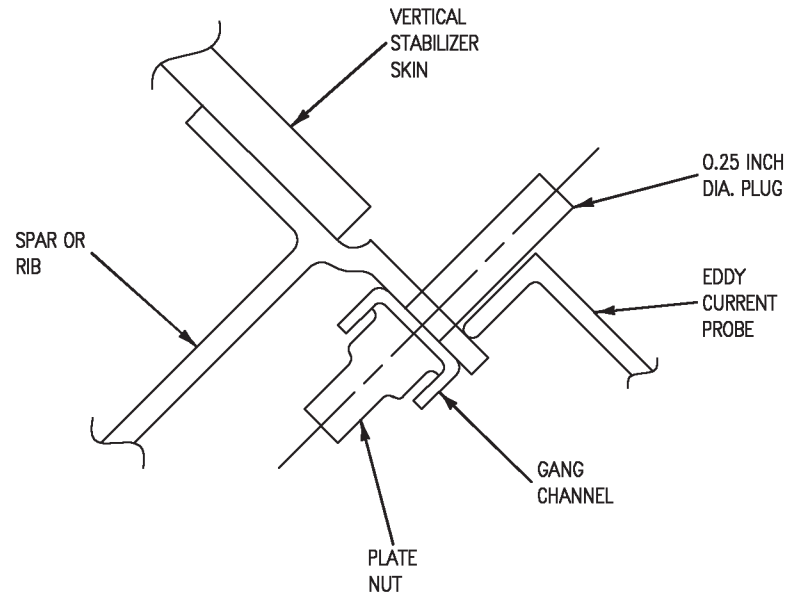




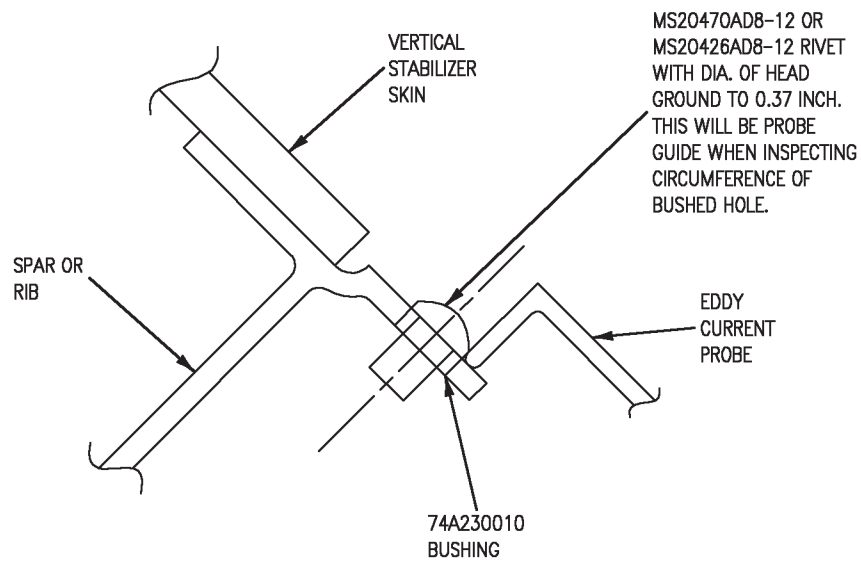
**Figure 1. Inspection Area**



**Figure 2. CRT Displays**



SECTION VIEW OF TYPICAL EDDY CURRENT SURFACE INSPECTION AROUND HOLE USING PLUG TO MAINTAIN CONSTANT EDGE DISTANCE.



SECTION VIEW OF TYPICAL EDDY CURRENT SURFACE INSPECTION AROUND HOLE USING RIVET WITH SHAVED HEAD TO MAINTAIN CONSTANT EDGE DISTANCE.

**Figure 3. Use of Hole Plug as Probe Guide**

## LIST HOLE NUMBERS FROM FIGURE 1 THAT WERE FOUND CRACKED


☐ RH VERTICAL STABILIZER

☐ LH VERTICAL STABILIZER

☐ NO CRACK INDICATIONS FOUND

## LOCATION

- |                                       |   |
|---------------------------------------|---|
| <input type="checkbox"/> ATSUGI       | <input type="checkbox"/> KANEOHE        |
| <input type="checkbox"/> BEAUFORT     | <input type="checkbox"/> LEMOORE        |
| <input type="checkbox"/> CECIL FIELD  | <input type="checkbox"/> NEW ORLEANS    |
| <input type="checkbox"/> CHERRY POINT | <input type="checkbox"/> NORFOLK        |
| <input type="checkbox"/> CHINA LAKE   | <input type="checkbox"/> NORTH ISLAND   |
| <input type="checkbox"/> DALLAS       | <input type="checkbox"/> PATUXENT RIVER |
| <input type="checkbox"/> EL TORO      | <input type="checkbox"/> PENSACOLA      |
| <input type="checkbox"/> FALLON       | <input type="checkbox"/> POINT MUGU     |
| <input type="checkbox"/> IWAKUNI      | <input type="checkbox"/> WASHINGTON     |
| <input type="checkbox"/> JACKSONVILLE | <input type="checkbox"/> YUMA           |
| <input type="checkbox"/> OTHER _____  |   |

SQUADRON \_\_\_\_\_

BUREAU NO. \_\_\_\_\_

MCAIR CUM NO. \_\_\_\_\_

FLIGHT HOURS \_\_\_\_\_

NO. OF LANDINGS \_\_\_\_\_

INSPECTION DATE \_\_\_\_\_

INSPECTOR \_\_\_\_\_

**Figure 4. Documentation Sheet**

## INTERMEDIATE MAINTENANCE

## NONDESTRUCTIVE INSPECTION

## RUDDER

## WATER IN HONEYCOMB

## PART NO. 74A240700

## Reference Material

Naval Aviation Maintenance Program .....	OPNAVINST 4790.2
Nondestructive Inspection Methods .....	NAVAIR 01-1A-16
Nondestructive Inspection .....	A1-F18AC-SRM-300
General Information .....	WP003 00
Radiographic Method .....	WP005 00

## Alphabetical Index

Subject	Page No.
Rudder .....	1
Defects .....	1
Primary Inspection Method .....	1

## Record of Applicable Technical Directives

None

1. **RUDDER.**

OPNAVINST 4790.2 SERIES, NDI Technicians,  
NEC 7225/MOS 6044.

2. Rudder is bonded honeycomb assembly. Honeycomb core is 0.125 and 0.188 hexagonal cell, 5056 aluminum alloy. Skins are graphite epoxy laminate. Structure is titanium and fiberglass molding. Surface finish is epoxy primer and polyurethane coating.

6. **Preparation of Aircraft.** No special preparation required.

7. **Access.** No special access required.

3. **DEFECTS.** Inspect for water trapped in honeycomb core. Example of defect is contained in WP003 00.

8. **Preparation of Part.** No special preparation required.

4. **PRIMARY INSPECTION METHOD.** Primary inspection method is radiographic.

## Support Equipment Required

5. **Personnel Qualifications.** Personnel doing this nondestructive inspection should be qualified and certified to do radiographic inspections per

Part Number or  
Type Designation

## Nomenclature

314X

Film Identification Set

### Support Equipment Required (Continued)

Part Number or Type Designation	Nomenclature
MIL-STD-453 GXR7-6B	Penetrameter Set X-ray Apparatus, Portable
072000	X-ray Film Processor

### Materials Required

Specification or Part Number	Nomenclature
INDUSTREX M FILM CODE M2	Radiographic Film, X-ray Film, 14x17 and 5x7
INDUSTREXAA FILM CODE AA2 14x17	Radiographic Film, X-ray Film, 14x17 and 5x7
MIL-P-83953-2, TYPE 1, CLASS A or B, RED or BLACK	Aircraft Marking Pencil
A-A-883, TYPE 1	Pressure Sensitive Tape, Masking Tape

### WARNING

#### HIGH RADIATION

Make sure applicable safety precautions in WP005 00 and NAVAIR 01-1A-16 are complied with. Failure to comply may result in injury to personnel.

#### 9. Equipment Settings/Standardization/Setup.

Set the X-ray unit per data contained in technique chart, see figure 1.

#### 10. Inspection Procedure.

##### NOTE

X-ray film for all shots are double loaded. AA film is located next to part and both films are exposed simultaneously.

a. Locate films 1 and 2, see sheet 1 of figure. Film should be taped to inboard surface of rudder with identification markers taped to source side of film pack and penetrameters taped to source side of rudder.

b. Locate source to aiming point for shot 1. Source should be normal to aiming point.

c. Expose films 1 and 2 simultaneously using technique chart settings for shot 1. Remove exposed film from the part.

d. Repeat steps a through c for films 3 and 4 and shot 2.

e. Repeat steps a through c for film 5 and shot 3.

f. Repeat steps a through c for film 6 and shot 4.

g. Repeat steps a through c for films 7 and 8 and shot 5. See sheet 2 of the figure for locating film and source to aiming point.

h. Repeat steps a through c for films 9 through 11 and shot 6. See sheet 3 of the figure for locating film and source to aiming point.

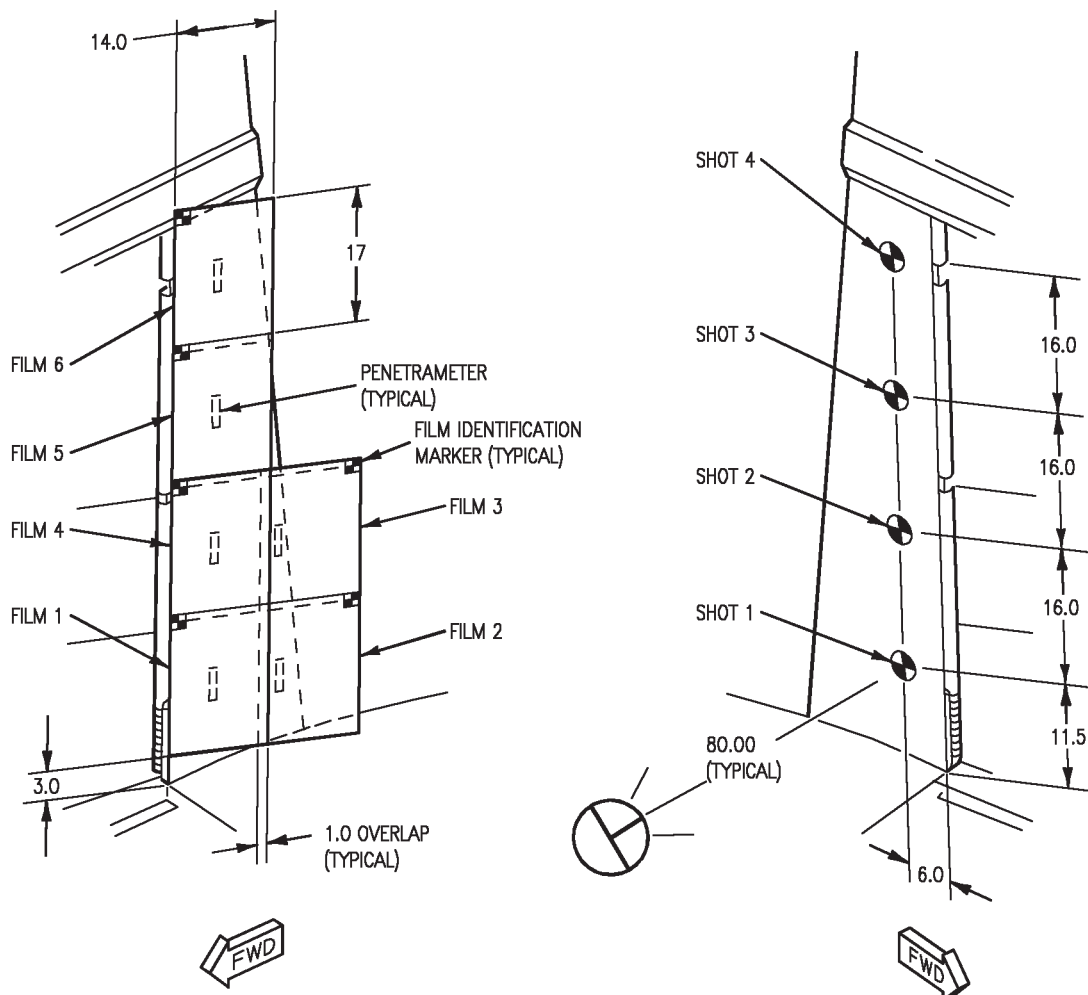
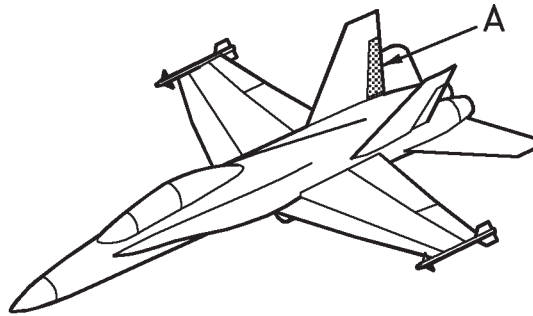
i. Repeat steps a through c for films 12 through 14 and shot 7.

j. Repeat steps a through c for films 15 through 17 and shot 8.

k. Repeat steps a through c for films 18 and 19 and shot 9.

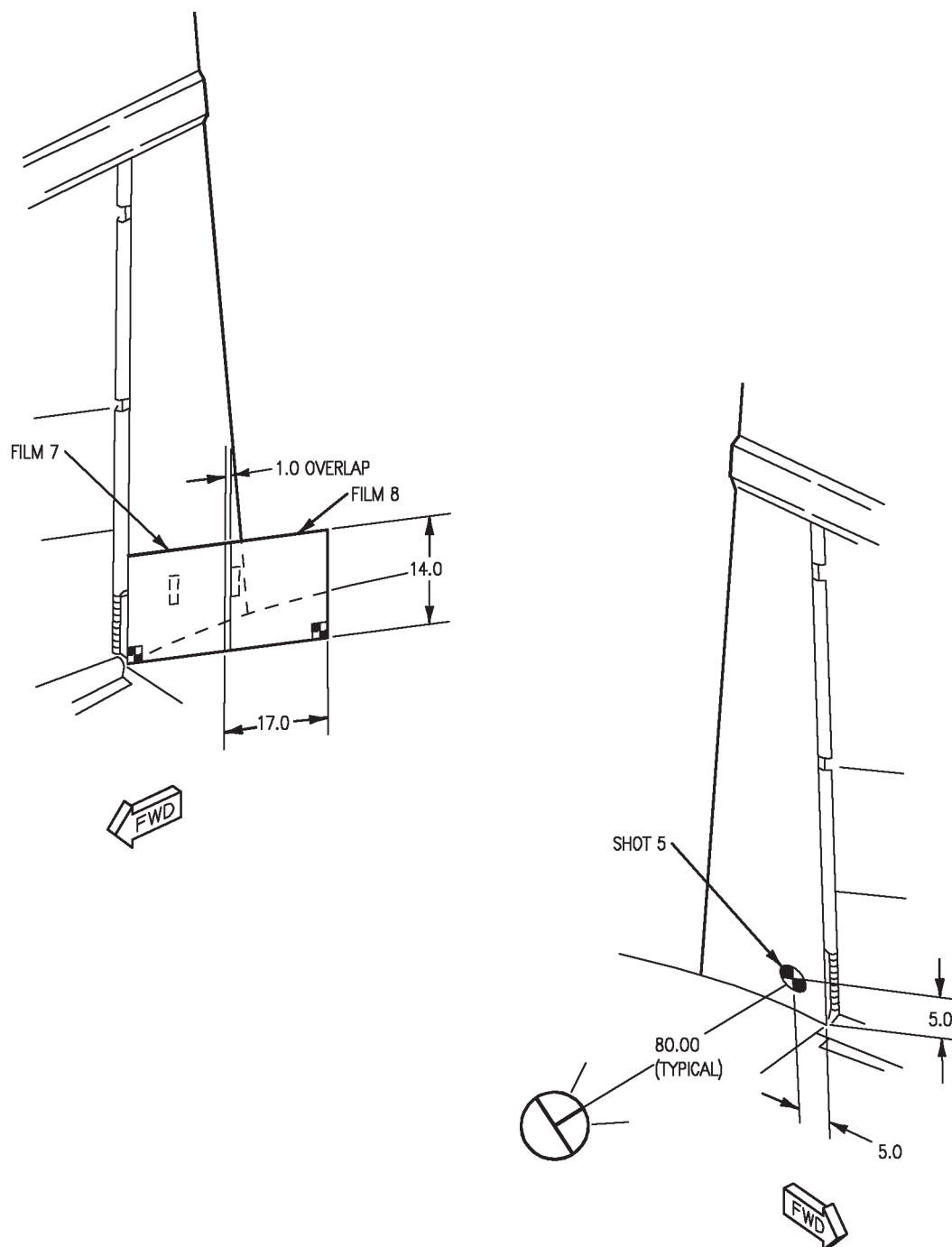
l. Process exposed film. Interpret radiographs for water trapped in honeycomb core (WP005 00).

m. Mark defect(s) using aircraft marking pencil.



A

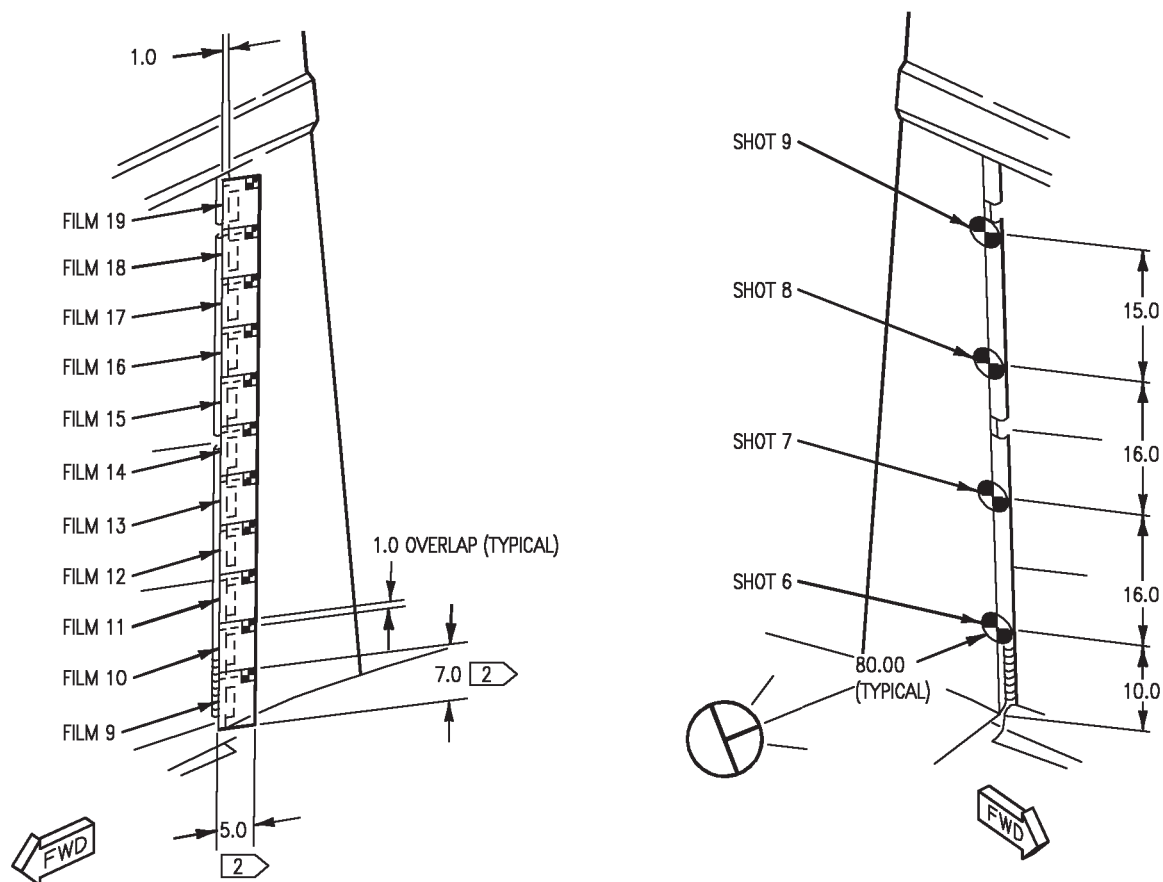
Figure 1. Rudder, Water in Honeycomb (Sheet 1)



A

Figure 1. Rudder, Water in Honeycomb (Sheet 2)





A

TECHNIQUE CHART								
SHOT	FILM SIZE	FILM GROUP	BACK SCREEN	PENETRATOR MIL-STD-453	mA	kVP	EXPOSURE (MINUTES)	<span style="border: 1px solid black; padding: 0 2px;">1</span> DENSITY
1 THRU 4	14 X 17	AA AND M	0.010Pb	0.25AL	2.5	40	3	1.0 - 3.5
5	14 X 17	AA AND M	0.010Pb	0.25AL	4.0	65	3 1/4	1.0 - 3.5
6 THRU 9	5 X 7	AA AND M	0.010Pb	0.25Ti	4.0	75	3 1/4	1.0 - 3.5

## LEGEND

- 1 H AND D DENSITY UNITS.
- 2 14 X 17 CUT AND BAGGED FILM WHICH COVERS SPECIFIED AREA MAY ALSO BE USED.

Figure 1. Rudder, Water in Honeycomb (Sheet 3)



## INTERMEDIATE MAINTENANCE

## NONDESTRUCTIVE INSPECTION

## RUDDER

## SKIN TO CORE AND TRAILING EDGE CLOSURE UNBONDS, AND SKIN DELAMINATIONS

## PART NO. 74A240700

## Reference Material

Naval Aviation Maintenance Program .....	OPNAVINST 4790.2
Plane Captain Manual .....	A1-F18AC-PCM-000
Nondestructive Inspection.....	A1-F18AC-SRM-300
General Information .....	WP003 00
Radiographic Method.....	WP005 00
Pulse Echo, Longitudinal Wave Contact, with Delay Line, for Composite Laminate Material Up to 0.190 Inch .....	WP008 03
Ultrasonic Through Transmission Contact Testing, Standardization, and Inspection Procedures for Composite Laminate Skins Bonded to Honeycomb Core.....	WP008 01
Pulse Echo, Longitudinal Wave Contact, with Delay Line, for Composite Laminate Material Bonded to Honeycomb Core .....	WP008 04
Ultrasonic Through Transmission Contact Testing, Standardization, and Inspection Procedures for Composite Laminate and Metallic Skins Bonded to Honeycomb Core .....	WP008 10
Pulse-Echo Longitudinal, Contact, Without Delay Line, for Composite Laminate Materials.....	WP008 11
Pulse-Echo Longitudinal, Contact, With Delay Line, for Composite Lami- nate Material Bonded to Honeycomb Core .....	WP008 13

## Alphabetical Index

Subject	Page No.
Rudder .....	2
Defects .....	2
Post Inspection Cleaning and Corrosion Control.....	6
Primary Inspection Method .....	2
Ultrasonic Method Using C-398 Ultrasonic Flaw Detector .....	2
Ultrasonic Method Using MXU-715/E Ultrasonic Flaw Detector .....	4

## Record of Applicable Technical Directives

None

**1. RUDDER.**

2. See figures 1 and 2. Rudder is bonded honeycomb assembly. Honeycomb core is 0.125 and 0.188 hexagonal cell 5056 aluminum alloy. Titanium structure encloses honeycomb. Trailing edge runout contains fiberite-epoxy molding compound. Skins are graphite epoxy composite laminate. Skin to core and skin to structure bonds are made with FM-300 film adhesive. Core to closeout bonds are made with metal-filled foaming adhesive. Surface finish is epoxy primer and polyurethane coatings.

3. **DEFECTS.** Inspect for skin to core unbonds, trailing edge closure unbonds, and skin delaminations. Example of skin to core unbonds may develop in bonded assembly is contained in (WP003 00).

4. **PRIMARY INSPECTION METHOD.** Primary inspection method is ultrasonic through transmission and pulse-echo.

5. **Personnel Qualifications.** Personnel doing this nondestructive inspection should be qualified and certified to do ultrasonic inspections per OPNAVINST 4790.2 SERIES, NDI Technicians, NEC 7225/MOS 6044.

6. **Preparation of Aircraft.** No special preparation required.

7. **Access.** No special access required.

**8. ULTRASONIC METHOD USING C-398  
ULTRASONIC FLAW DETECTOR.****Support Equipment Required****NOTE**

Alternate item type designations or part numbers are listed in parentheses.

**Part Number or  
Type Designation****Nomenclature**

C-398 (303B)

Ultrasonic Flaw  
Detector57A2271 or  
EQUIVALENTMicrodot to BNC  
Connecting Cable,  
2 Reqd.**Support Equipment Required  
(Continued)****NOTE**

Alternate item type designations or part numbers are listed in parentheses.

**Part Number or  
Type Designation****Nomenclature**57A2276 or  
EQUIVALENT0°, 0.500 Dia.,  
2.25 MHz, Contact  
Search Unit,  
2 Reqd.57A2275 or  
EQUIVALENT0°, 0.375 Dia.,  
2.25 MHz, Contact  
Search Unit

74D110175-1001

Graphite Epoxy Refer-  
ence Standard Set:

74D111295-1009

Graphite Epoxy Flat  
Bottom Hole  
Reference Standard  
for Laminates up to  
0.450 Inch

74D111295-1005

Honeycomb Reference  
Standard With  
Graphite Epoxy  
Skin for Sandwich  
Assemblies Less  
Than 1 Inch Thick

74D111295-1003

Honeycomb Reference  
Standard With  
Graphite Epoxy  
Skin for Sandwich  
Assemblies 1 to 2  
Inches Thick

74D111295-1001

Honeycomb Reference  
Standard With  
Graphite Epoxy  
Skin for Sandwich  
Assemblies 2 Inches  
or Taller**Materials Required****NOTE**

Alternate item specifications or part numbers are shown indented.

**Materials Required (Continued)**

Specification or Part Number	Nomenclature
ULTRAGEL II or EQUIVALENT	Couplant
MIL-P-83953-2, TYPE 1, CLASS A or B, RED or BLACK	Aircraft Marking Pencil
P-D-680, TYPE 2 D 1153	Dry Cleaning Solvent Methyl Isobutyl Ketone
CCC-C-46, TYPE 1, CLASS 4	Cleaning Cloth

**9. Preparation of Part.****WARNING**

1,1,1-Trichloroethane is toxic to eyes, skin, and respiratory tract. Skin and eye protection is required. Avoid repeated or prolonged contact. Good general ventilation is normally enough.

a. Clean inspection areas with solvent moistened cloth to be sure inspection areas are free of contamination or foreign material.

b. On rudder surface locate, mark, and identify inspection areas, core splice lines, and boundaries as shown in figure 1.

**WARNING**

Make sure safety precautions have been met for electrical, static, grounding when using ultrasonic equipment near aircraft fuel cells, oxygen systems, electronic systems, and stores (A1-F18AC-PCM-000).

**10. Equipment Settings/Standardization/Setup for Skin to Core Areas, see figures 3, 4, and 5..**

a. For all thicknesses of core 1 inch or less, 1 to 2 inches, and 2 inches or more, do Equipment Settings/Standardization/Setup (WP008 01), except as below:

(1) Use two 57A2276 search units.

(2) Use P-1 calibration point on applicable 74D111295 graphite/epoxy skinned honeycomb core sandwich assembly reference standard.

**11. Inspection Procedure for Skin to Core Areas.**

See figures 6, 7, and 8. Inspect skin to core areas of figure 1. per (WP008 01), except as below:

a. Use two 57A2276 search units.

b. Apply couplant to both surfaces of inspection area(s).

c. Make sure initial pulse width does not interfere with location of received response. If required, switch position of search units on microdot cables or use different search unit on receiver cable.

d. Use ultrasonic pulse-echo per (WP008 04) to determine if suspect areas are result of skin delaminations. Do pulse-echo inspection on both surfaces to help identify location of flaws causing through transmission unbond response. See figure 2 to identify skin thicknesses in marked areas.

**12. Equipment Settings/Standardization/Setup for Fiberite Filled Area. Do Equipment Settings/Standardization/Setup (WP008 02) except as below:**

a. Use one 57A2275 search unit.

b. Set ATTENUATORS 8 and 2 to in position.

c. Set COARSE SWEEP RANGE to 2 .

**NOTE**

GAIN may be adjusted by changing FINE GAIN, COARSE GAIN, or toggling ATTENUATORS.

d. Coupling transducer to 0.250 inch thick step of 74D111295-1009 reference standard, adjust FINE SWEEP DELAY, FINE SWEEP RANGE, and GAIN until CRT presentation is similar to figure 9.

**13. Inspection Procedure for Fiberite Filled Area.**

See figure 10.

a. Apply couplant to one side of inspection area.

b. Position search unit on inspection area and adjust Gain so reflected response is similar to figure 11, CRT 1.

c. Scan area to be inspected by finger damping back surface. Place couplant on end of finger and touch opposite surface. As finger touches and is then removed from part surface, reflected response will move up and down, damp, on CRT indicating good bond.

d. Unbond or delamination on search unit side will cause loss of reflected response on CRT, see figure 11, CRT 2.

e. Unbond or delamination on side opposite search unit will result in no movement of reflected response on CRT, see figure 11, CRT 3.

f. Mark all areas with aircraft marking pencil where reflected response is lost or cannot be finger damped.

g. Use ultrasonic pulse-echo method per (WP008 04) to determine if marked area is result of skin delaminations. Use figure 2 to identify skin thicknesses in area marked.

h. Do paragraph 20 .

### Support Equipment Required (Continued)

Part Number or Type Designation	Nomenclature
74D110175-1001	Graphite Epoxy Reference Standard Set:
74D111295-1009	Graphite Epoxy Flat Bottom Hole Reference Standard for Laminates up to 0.450 Inch
74D111295-1005	Honeycomb Reference Standard With Graphite Epoxy Skin for Sandwich Assemblies Less Than 1 Inch Thick
74D111295-1003	Honeycomb Reference Standard With Graphite Epoxy Skin for Sandwich Assemblies 1 to 2 Inches Thick
74D111295-1001	Honeycomb Reference Standard With Graphite Epoxy Skin for Sandwich Assemblies 2 Inches or Taller

### 14. ULTRASONIC METHOD USING MXU-715/E ULTRASONIC FLAW DETECTOR.

#### Support Equipment Required

Part Number or Type Designation	Nomenclature
1642AS100-1	Ultrasonic Flaw Detector, MXU-715/E, Magnaflux
57A2271 or EQUIVALENT	Microdot to BNC Connecting Cable, 2 Req'd.
57A2276 or EQUIVALENT	0°, 0.500 Dia., 2.25 MHz, Contact Search Unit, 2 Req'd.
57A2275 or EQUIVALENT	0°, 0.375 Dia., 2.25 MHz, Contact Search Unit

#### Materials Required

##### NOTE

Alternate item specifications or part numbers are shown indented.

Specification or Part Number	Nomenclature
ULTRAGEL II or EQUIVALENT	Couplant
MIL-P-83953-2, TYPE 1, CLASS A or B, RED or BLACK	Aircraft Marking Pencil
P-D-680, TYPE 2 D 1153	Dry Cleaning Solvent Methyl Isobutyl Ketone
CCC-C-46, TYPE 1, CLASS 4	Cleaning Cloth

## 15. Preparation of Part.

**WARNING**

1,1,1-Trichloroethane is toxic to eyes, skin, and respiratory tract. Skin and eye protection is required. Avoid repeated or prolonged contact. Good general ventilation is normally enough.

a. Clean inspection areas with solvent moistened cloth to be sure inspection areas are free of contamination or foreign material.

b. On rudder surface locate, mark, and identify inspection areas, core splice lines, and boundaries as shown in figure 1.

**WARNING**

Make sure safety precautions have been met for electrical, static, grounding when using ultrasonic equipment near aircraft fuel cells, oxygen systems, electronic systems, and stores (A1-F18AC-PCM-000).

## 16. Equipment Settings/Standardization/Setup for Skin to Core Areas. See figures 3, 4, and 5..

a. For all thicknesses of core 1 inch or less, 1 to 2 inches, and 2 inches or more, do Equipment Settings/Standardization/Setup (WP008 10), except as below:

(1) Use two 57A2276 search units.

(2) Use P-1 calibration point on applicable 74D111295 graphite/epoxy skinned honeycomb core sandwich assembly reference standard.

## 17. Inspection Procedure for Skin to Core Areas.

See figures 6, 7, and 8. Inspect skin to core areas of figure 1 per (WP008 10), except as below:

a. Use two 57A2276 search units.

b. Apply couplant to both surfaces of inspection area(s).

c. Make sure initial pulse width does not interfere with location of received response. If required, switch position of search units on

microdot cables or use different search unit on receiver cable.

d. Use ultrasonic pulse-echo per (WP008 13) to determine if suspect areas are result of skin delaminations. Do pulse-echo inspection on both surfaces to help identify location of flaws causing through transmission unbond response. See figure 2 to identify skin thicknesses in marked areas.

## 18. Equipment Settings/Standardization/Setup for Fiberite Filled Area. Do Equipment

Settings/Standardization/Setup (WP008 11) except as below:

a. Use one 57A2275 search unit.

b. Set COARSE GAIN to 4 and FINE GAIN to 0.

c. Set COARSE HORIZ SWEEP LENGTH to 2 and FINE HORIZ SWEEP LENGTH to 8.

d. Coupling transducer to 0.250 inch thick step of 74D111295-1009 reference standard, adjust FINE HORIZ SWEEP DELAY, FINE HORIZ SWEEP LENGTH, and GAIN until CRT presentation is similar to figure 9.

## 19. Inspection Procedure for Fiberite Filled Area.

See figure 10.

a. Apply couplant to one side of inspection area.

b. Position search unit on inspection area and adjust Gain so reflected response is similar to figure 11, CRT 1.

c. Scan area to be inspected by finger damping back surface. Place couplant on end of finger and touch opposite surface. As finger touches and is then removed from part surface, reflected response will move up and down, damp, on CRT indicating good bond.

d. Unbond or delamination on search unit side will cause loss of reflected response on CRT, see figure 11, CRT 2.

e. Unbond or delamination on side opposite search unit will result in no movement of reflected response on CRT, see figure 11, CRT 3.

f. Mark all areas with aircraft marking pencil where reflected response is lost or cannot be finger damped.

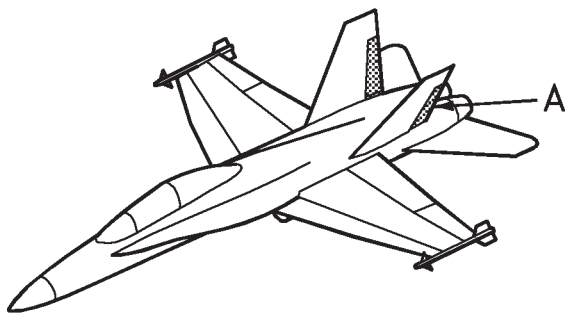
g. Use ultrasonic pulse-echo method per (WP008 13) to determine if marked area is result of skin delaminations. Use figure 2 to identify skin thicknesses in area marked.

## WARNING

Dry cleaning solvent and methyl isobutyl ketone are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

20. **POST INSPECTION CLEANING AND CORROSION CONTROL.** Clean couplant and markings from rudder with solvent moistened cloth.





## LEGEND

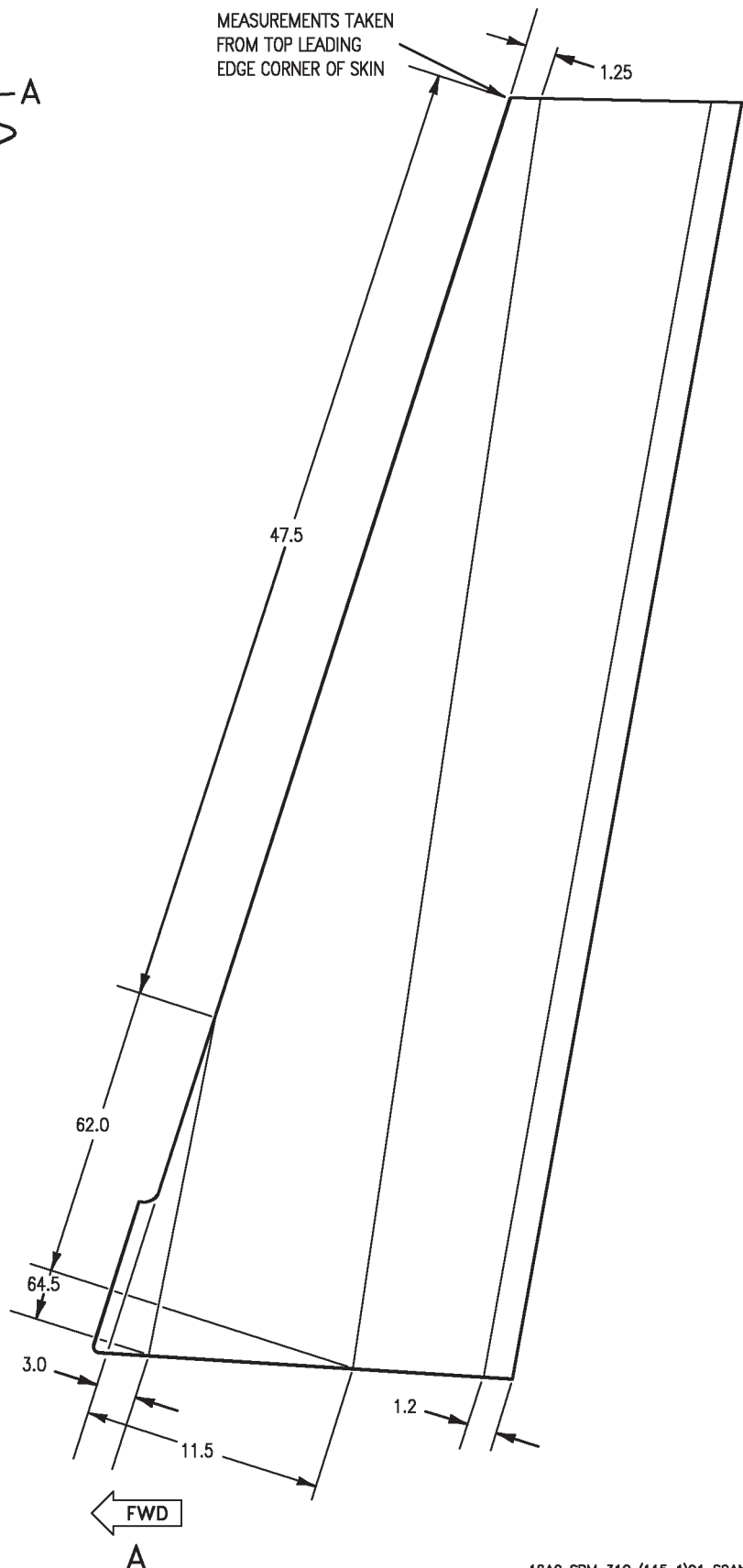
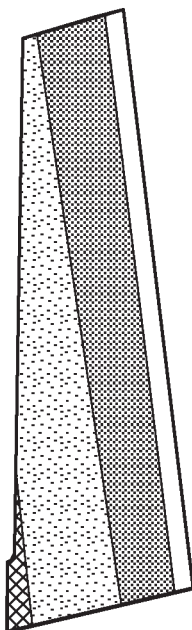
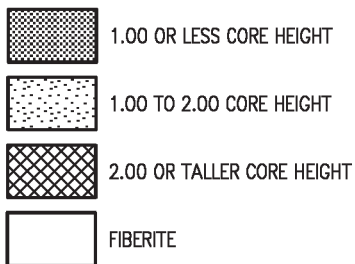


Figure 1. Structure and Core Splice Lines (Sheet 1)

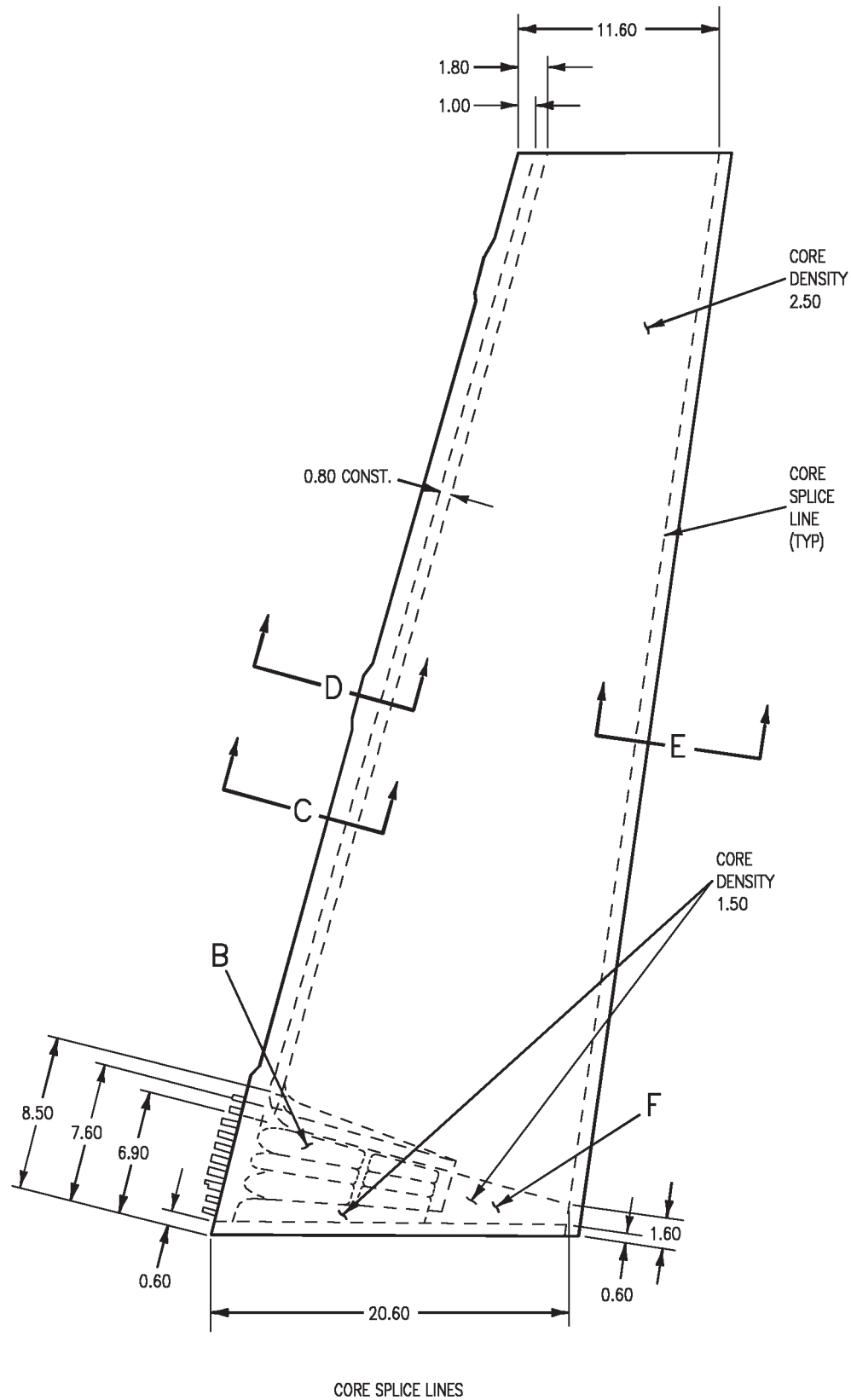


Figure 1. Structure and Core Splice Lines (Sheet 2)

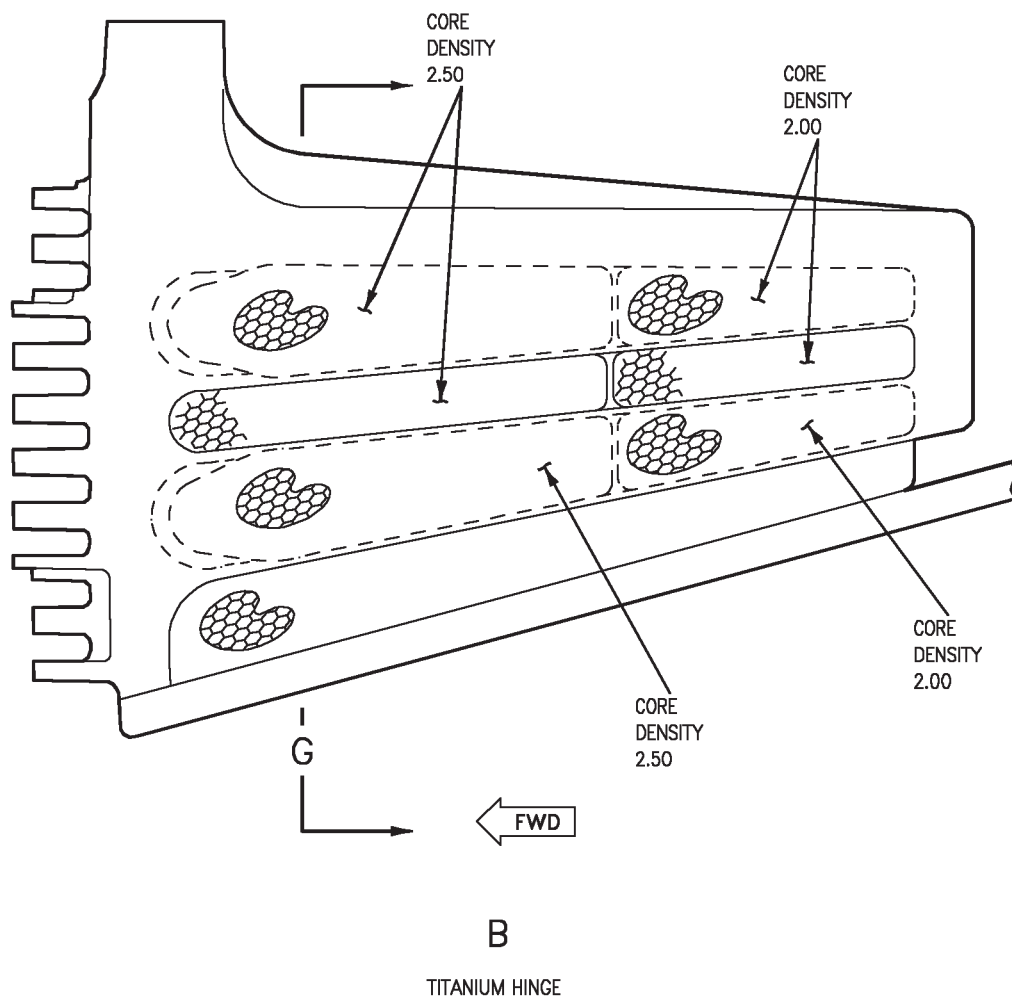


Figure 1. Structure and Core Splice Lines (Sheet 3)

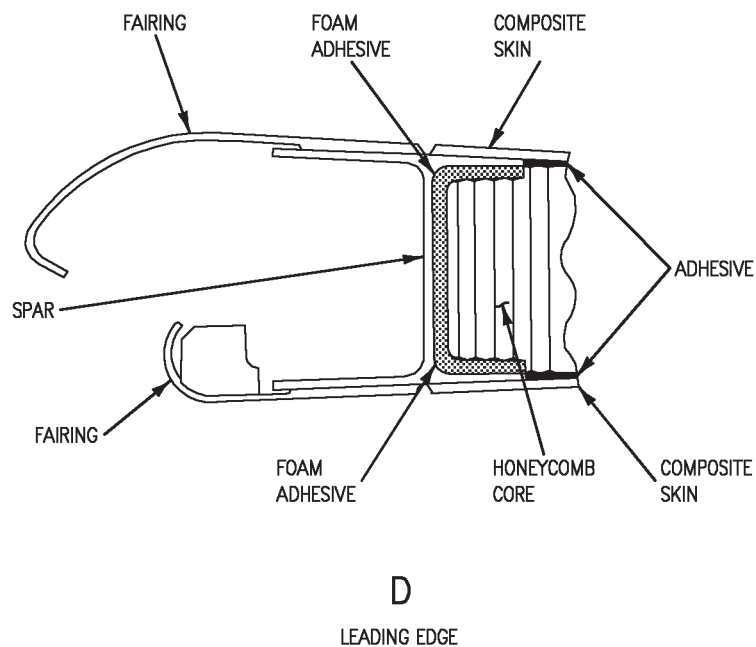
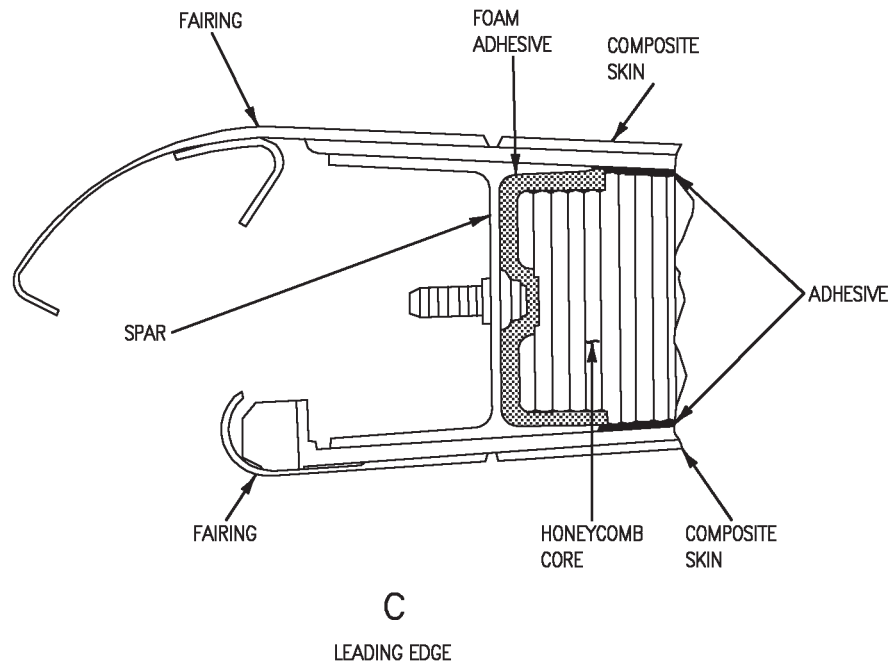


Figure 1. Structure and Core Splice Lines (Sheet 4)

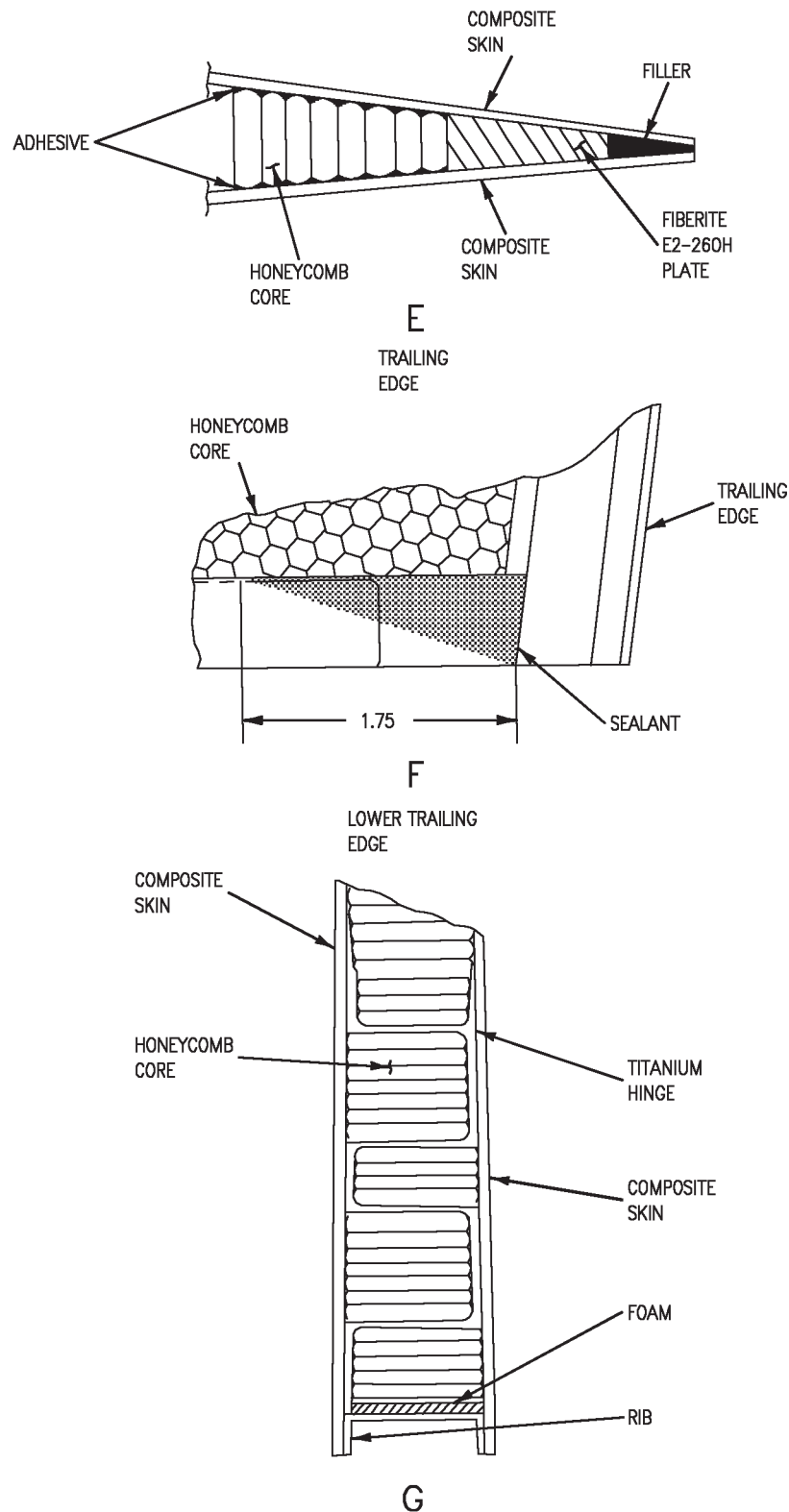


Figure 1. Structure and Core Splice Lines (Sheet 5)

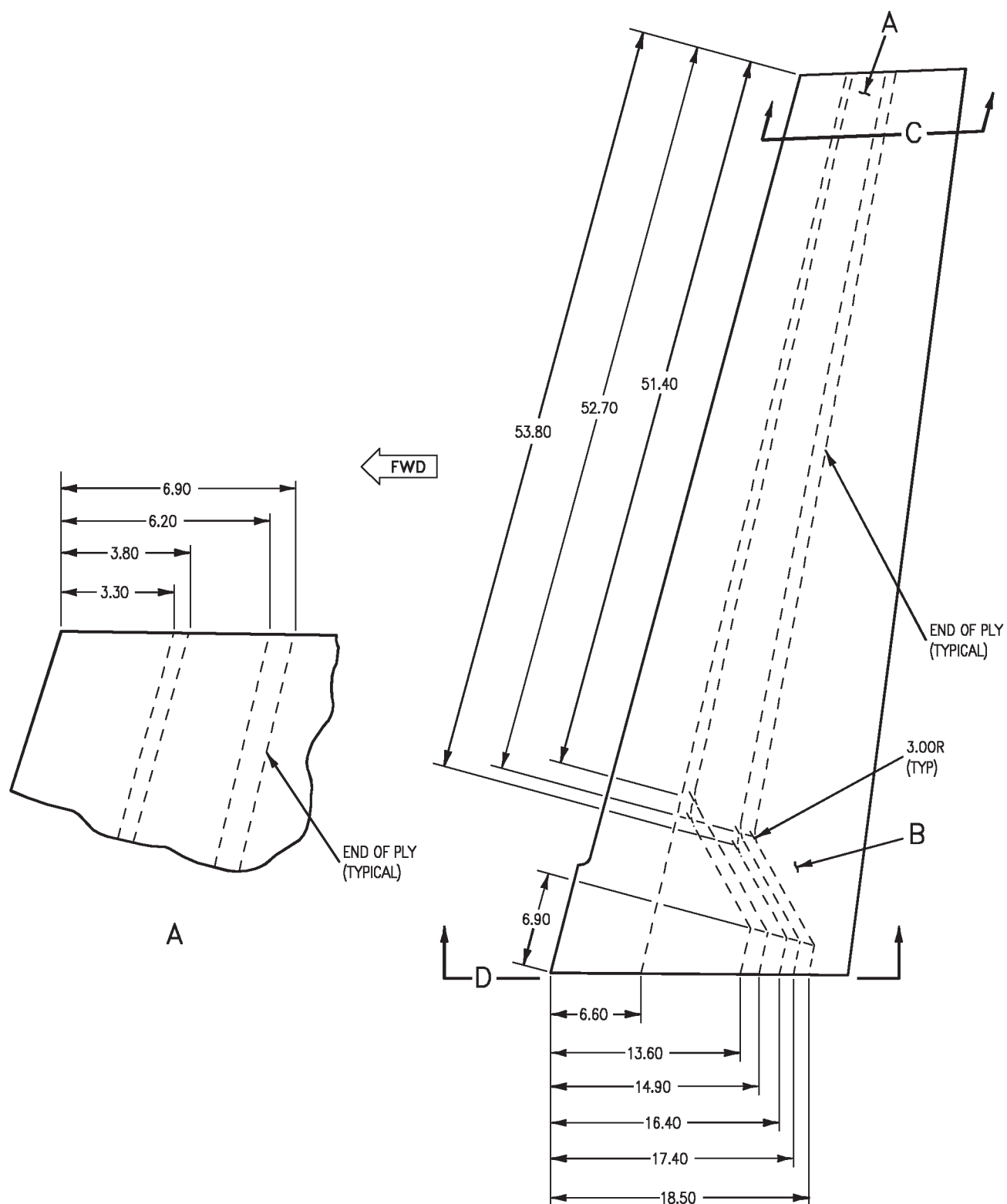


Figure 2. Composite Skin Thickness (Sheet 1)

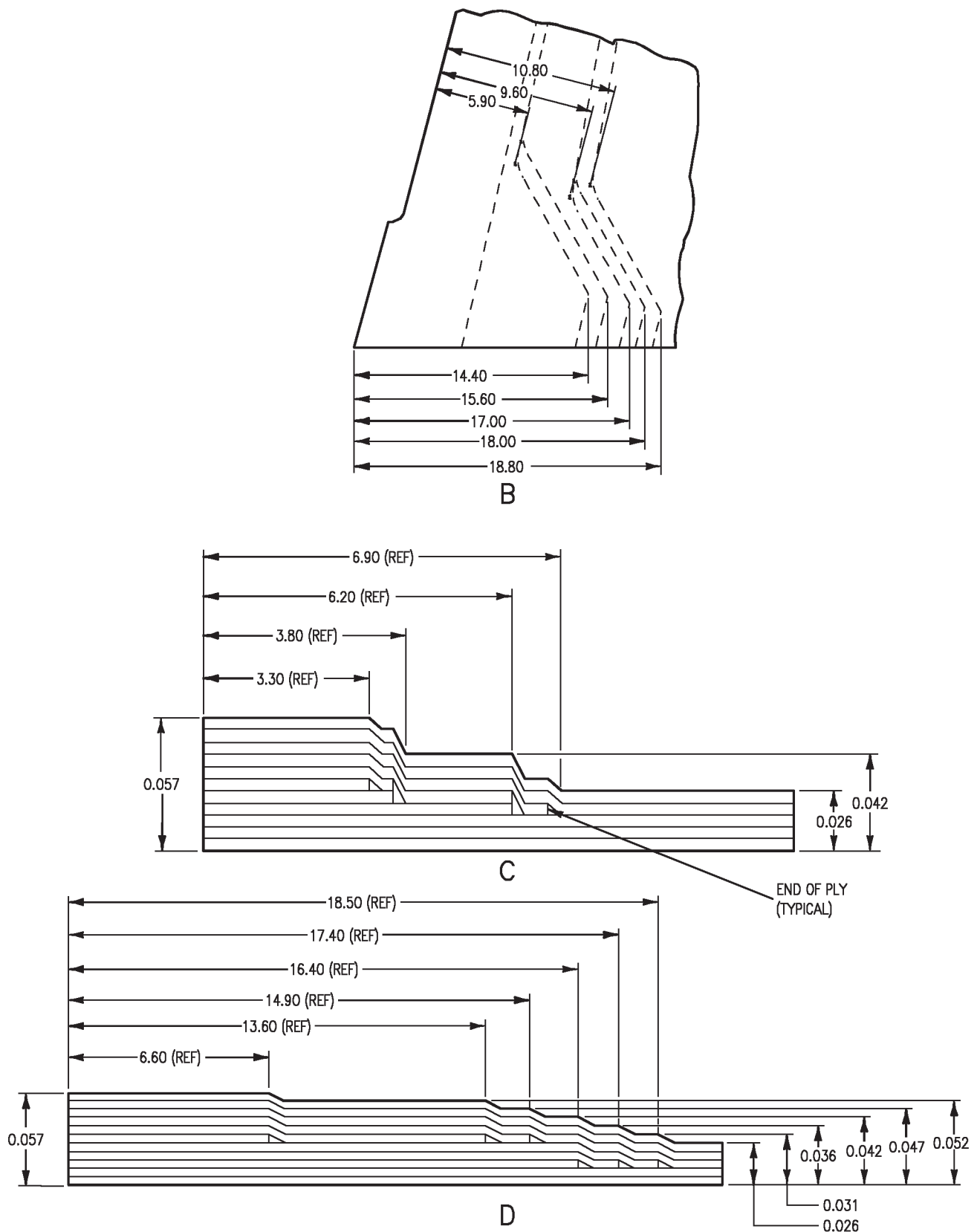
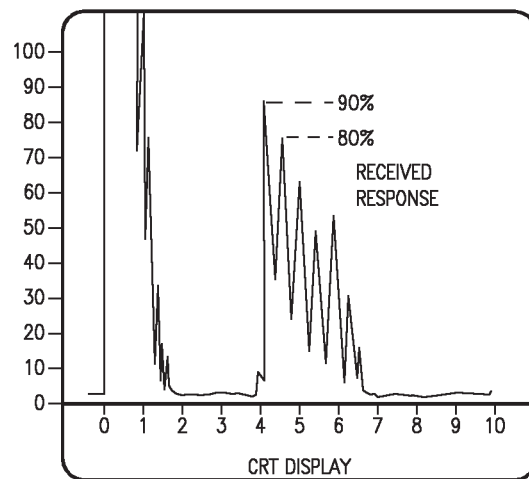
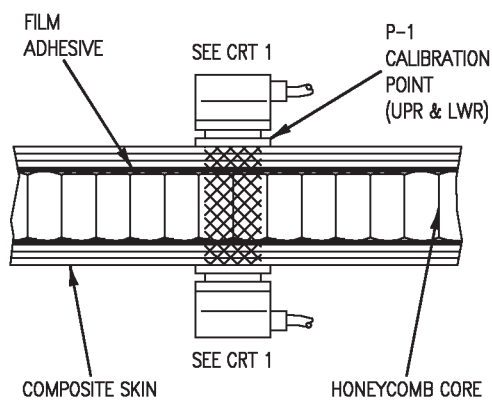


Figure 2. Composite Skin Thickness (Sheet 2)

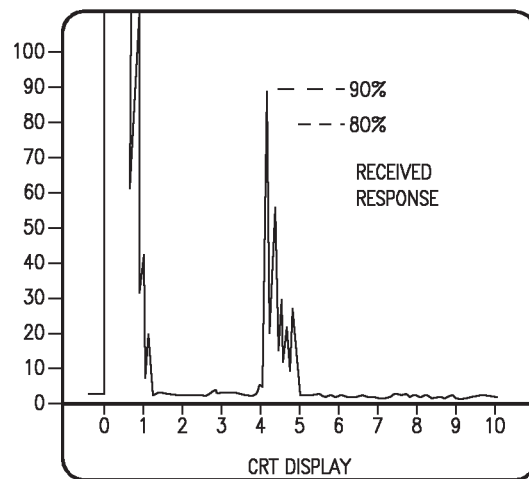
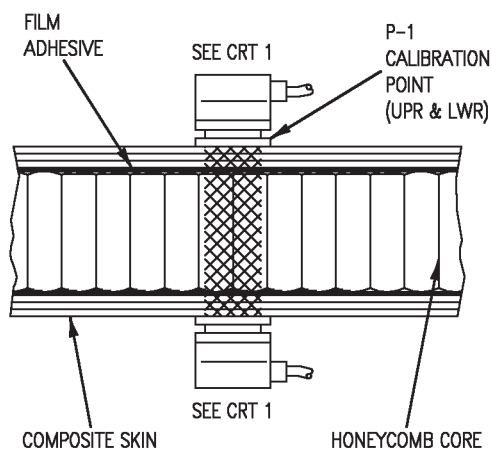


CRT 1

LEADING EDGE OF RECEIVED RESPONSE  
LOCATED AT 4 ON THE HORIZONTAL BASELINE.

**Figure 3. Standardization on One Half Inch Tall Graphite Epoxy Skinned Honeycomb Core Sandwich Assembly Reference Standard**

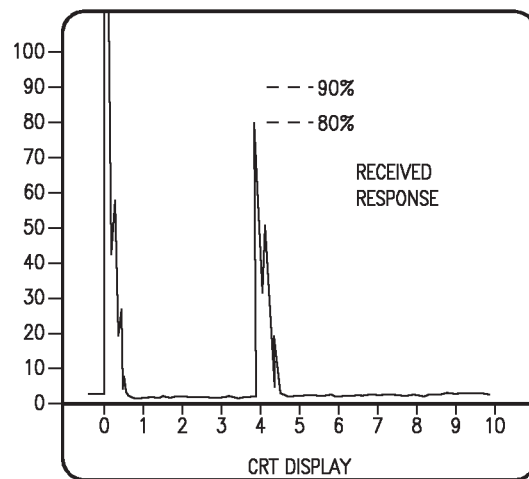
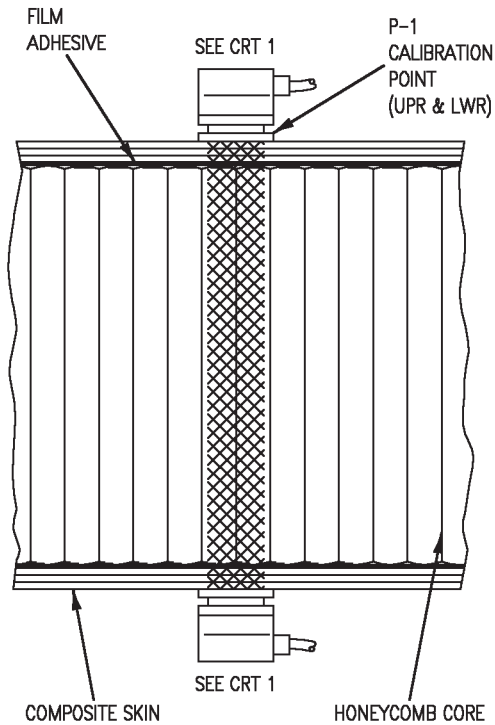




CRT 1

LEADING EDGE OF RECEIVED RESPONSE  
LOCATED AT 4 ON THE HORIZONTAL BASELINE.

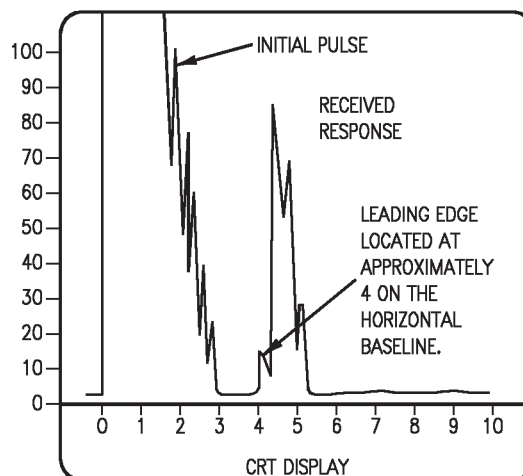
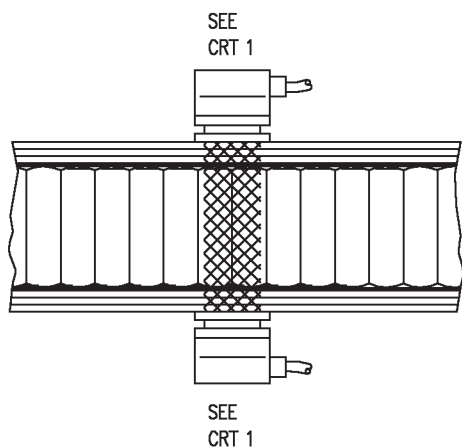
**Figure 4. Standardization on One Inch Tall Graphite Epoxy Skinned Honeycomb Core Sandwich Assembly Reference Standard**



CRT 1

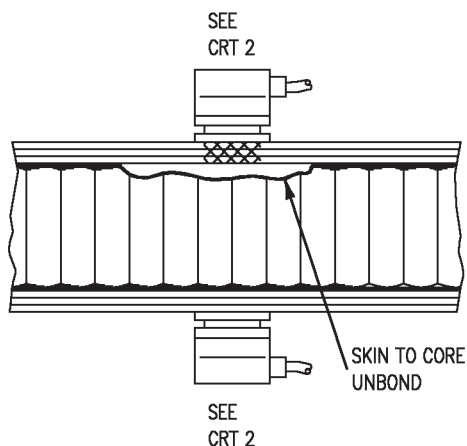
LEADING EDGE OF RECEIVED RESPONSE  
LOCATED AT 4 ON THE HORIZONTAL BASELINE.

**Figure 5. Standardization on Three Inch Tall Graphite Epoxy Skinned Honeycomb Core Sandwich Assembly Reference Standard**



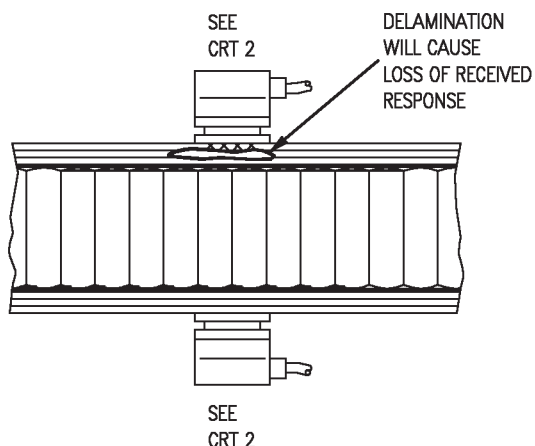
**CRT 1**

TYPICAL SKIN TO CORE AREA  
GOOD BOND RESPONSE.

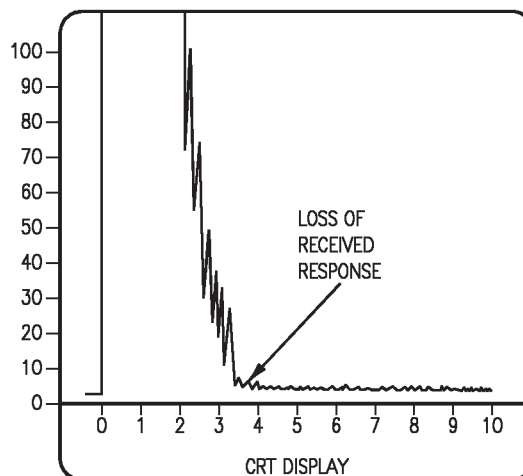


SEE  
CRT 2

OR



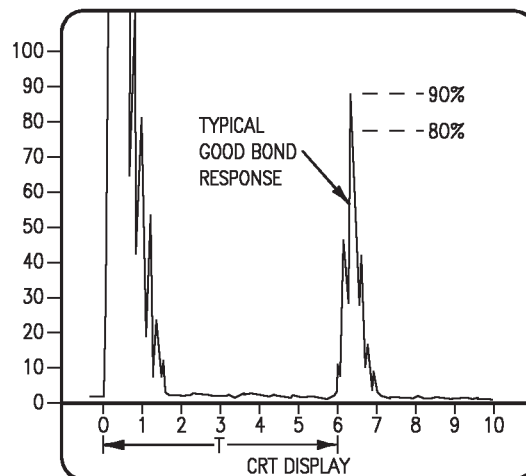
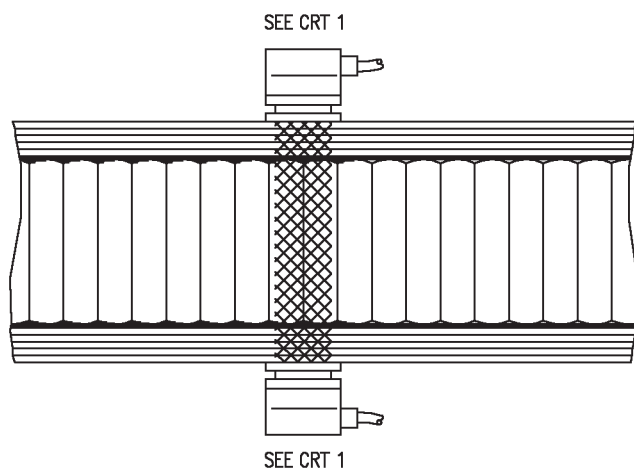
SEE  
CRT 2



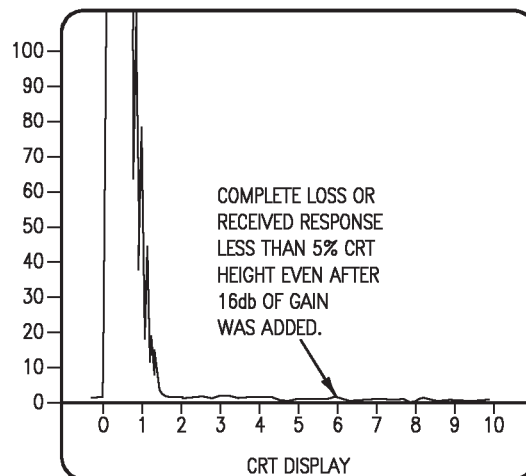
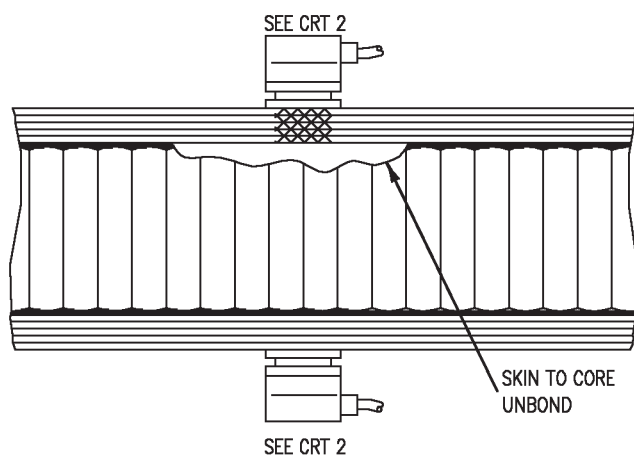
**CRT 2**

TYPICAL SKIN TO CORE AREA  
UNBOND RESPONSE.

**Figure 6. One Inch or Less Honeycomb Core Area Inspection Responses**



CRT 1



CRT 2

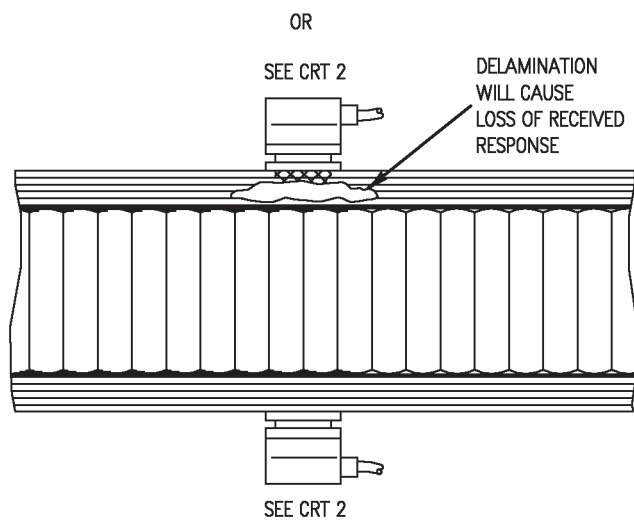
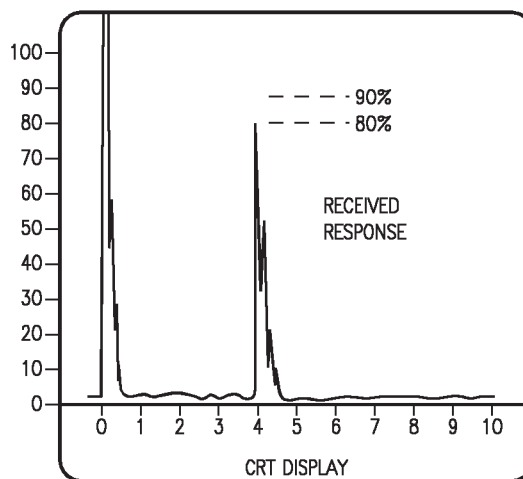
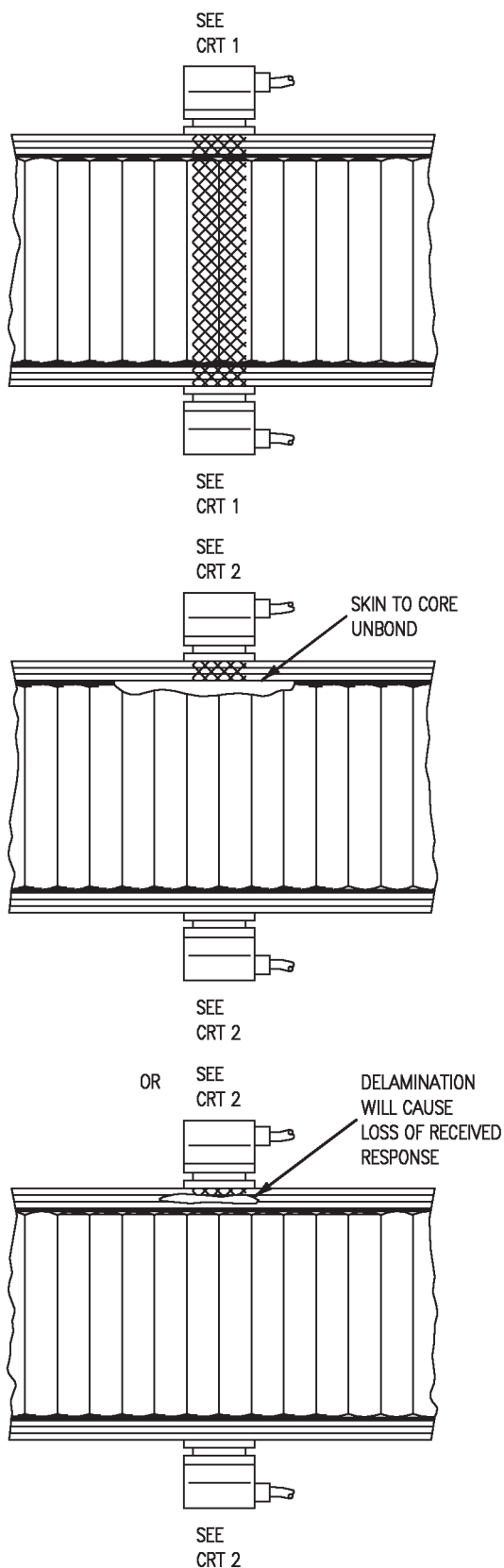
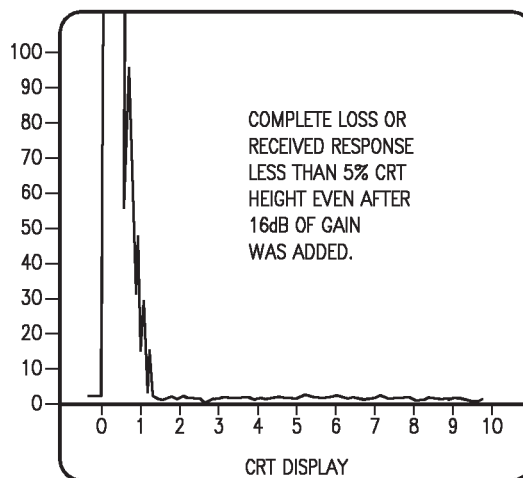


Figure 7. One to Two Inch Honeycomb Core Area Inspection Responses



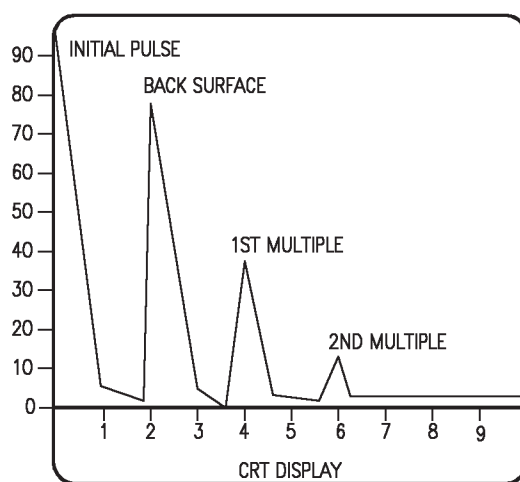
**CRT 1**

LEADING EDGE OF RECEIVED RESPONSE  
LOCATED AT 4 ON THE HORIZONTAL  
BASELINE.



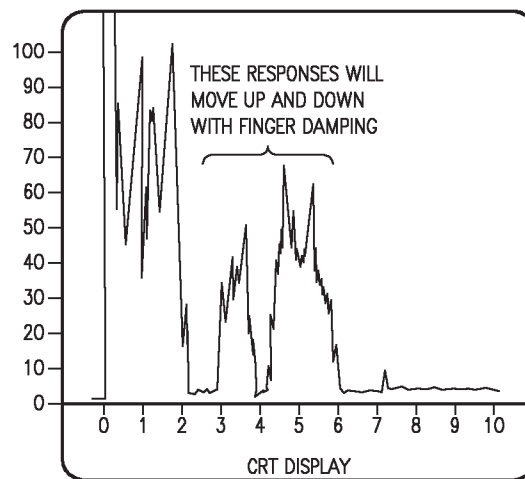
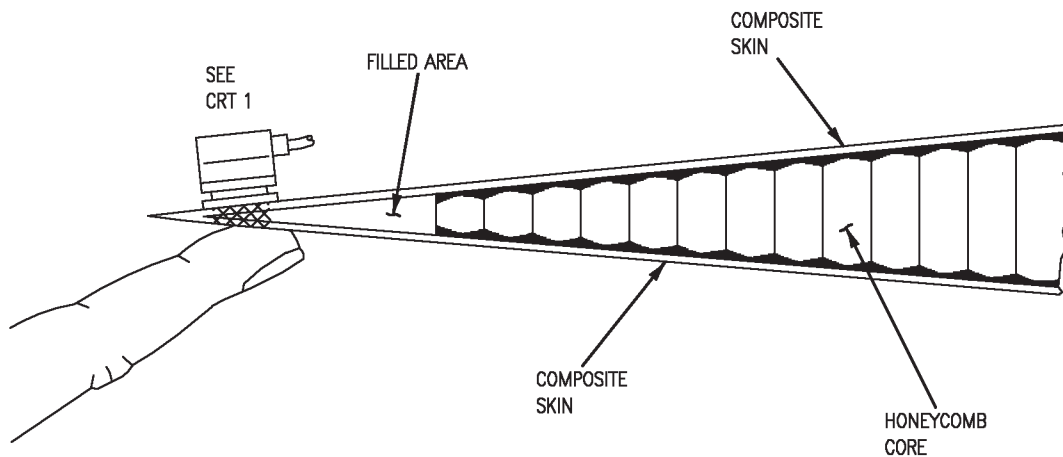
**CRT 2**

**Figure 8. Two Inch or Taller Honeycomb Core Area Inspection Responses**



CRT 1

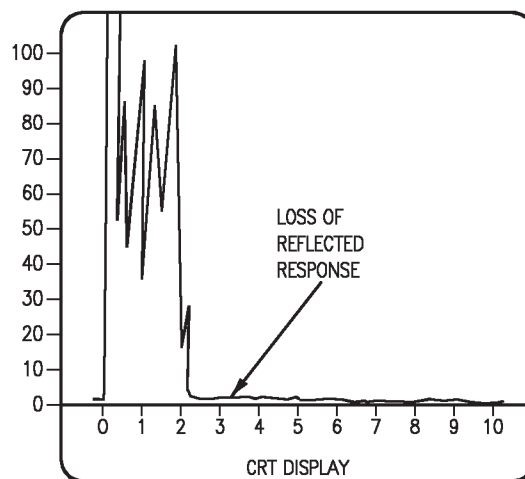
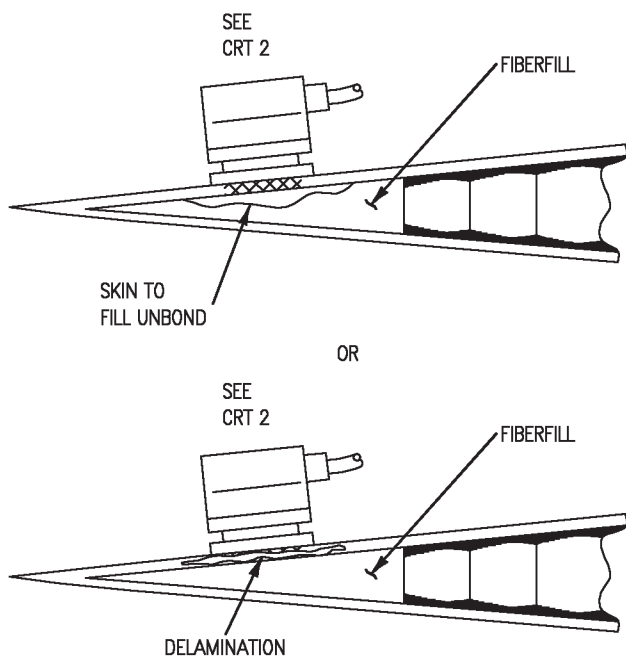
Figure 9. CRT Presentation for Filled Area Inspection Setup



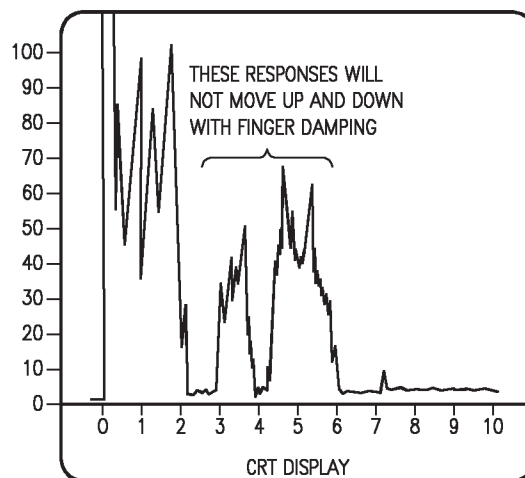
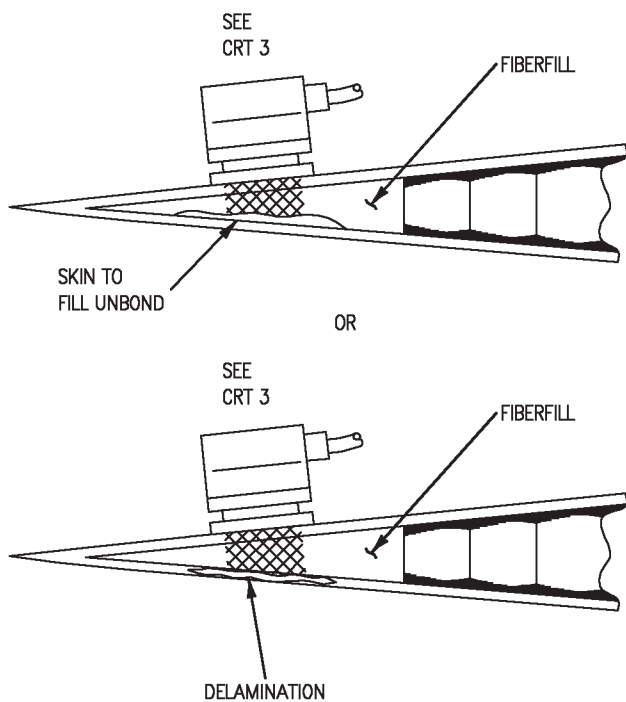
CRT 1

TYPICAL GOOD BOND RESPONSE

Figure 10. Ultrasonic Responses in Filled Area (Sheet 1)



**CRT 2**  
UNBOND OR DELAMINATION  
ON SEARCH UNIT SIDE



**CRT 3**  
UNBOND OR DELAMINATION  
ON SIDE OPPOSITE SEARCH UNIT

**Figure 10. Ultrasonic Responses in Filled Area (Sheet 2)**



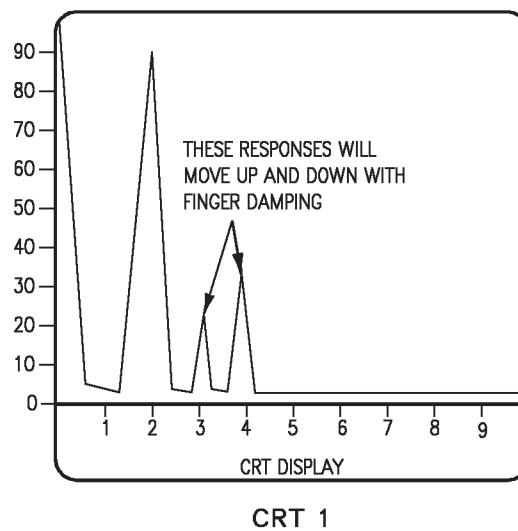
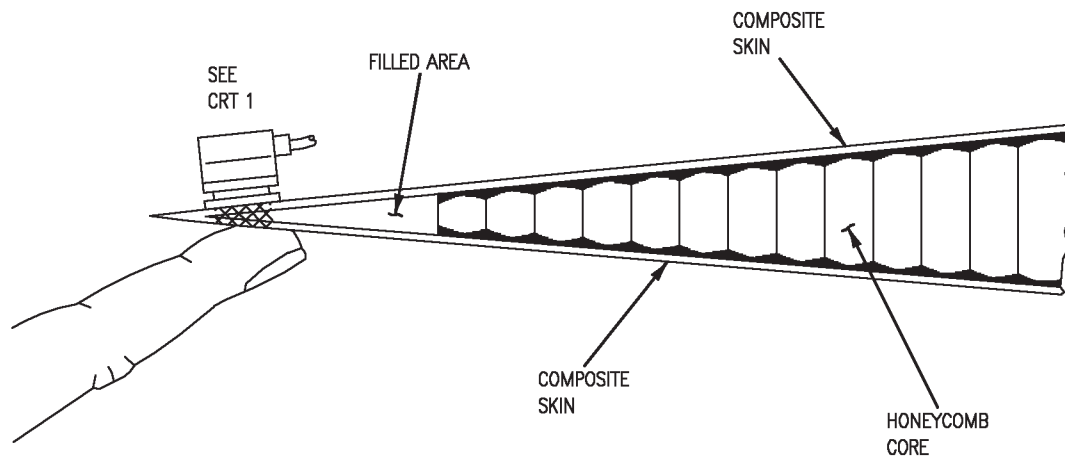
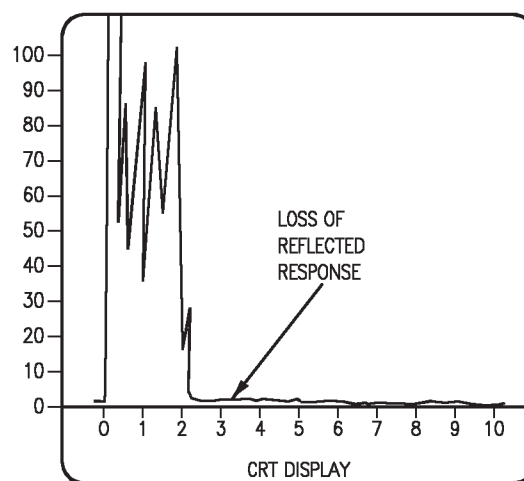
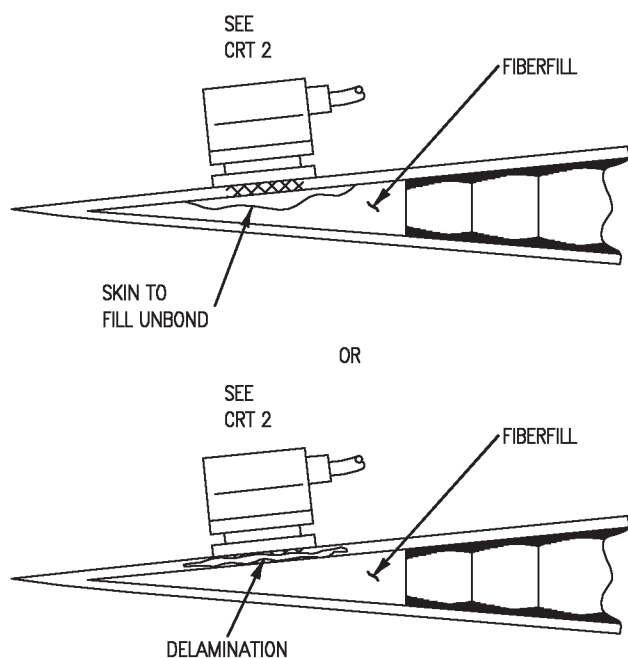
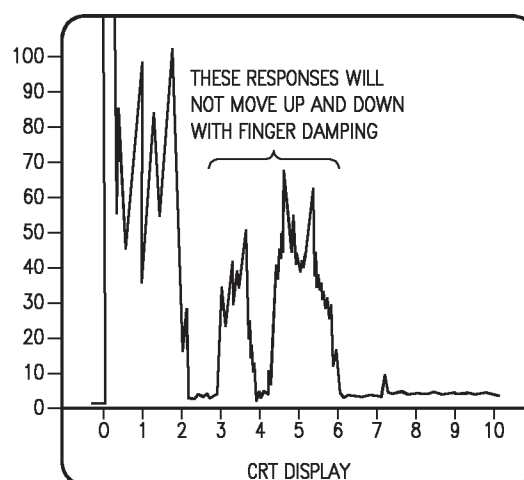
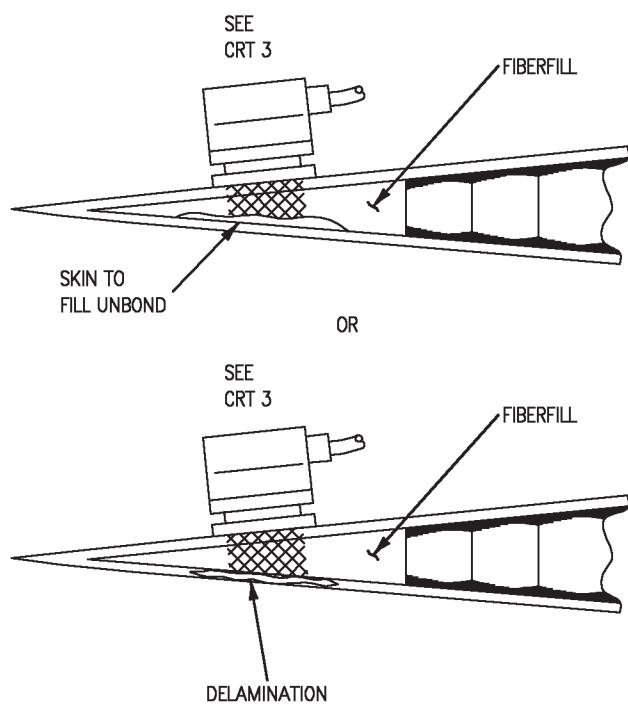


Figure 10. Ultrasonic Responses in Filled Area (Sheet 1)



CRT 2

UNBOND OR DELAMINATION  
ON SEARCH UNIT SIDE



CRT 3

UNBOND OR DELAMINATION  
ON SIDE OPPOSITE SEARCH UNIT

Figure 10. Ultrasonic Responses in Filled Area (Sheet 2)

## INTERMEDIATE MAINTENANCE

## NONDESTRUCTIVE INSPECTION

## MAIN LANDING GEAR AXLE

## FATIGUE CRACKS

## PART NO. 74A410508

This WP supersedes WP068 00, dated 15 December 1992.

## Reference Material

Naval Aviation Maintenance Program .....	OPNAVINST 4790.2
Landing Gear And Related Systems.....	A1-F18AC-130-300
MLG Axle Assembly.....	WP041 00
Multiple Disk Brake.....	WP064 00
Line Maintenance Procedures.....	A1-F18AC-LMM-000
Aircraft Weapons Systems Cleaning and Corrosion Control.....	NAVAIR 01-1A-509
Nondestructive Inspection Methods.....	NAVAIR 01-1A-16
Aircraft Corrosion Control.....	A1-F18AC-SRM-500
Sealing Methods.....	WP010 00
Priming Procedures .....	WP011 00
Finish System .....	WP012 00
Nondestructive Inspection.....	A1-F18AC-SRM-300
Penetrant Method.....	WP004 00
Magnetic Particle Method.....	WP006 00

## Alphabetical Index

Subject	Page No.
Main Landing Gear Axle .....	1
Backup Inspection Method .....	3
Defects .....	2
Post Inspection Cleaning and Corrosion Control.....	4
Primary Inspection Method .....	2
System Securing.....	4

## Record of Applicable Technical Directives

None

## 1. MAIN LANDING GEAR AXLE.

2. Main landing gear axle is machined from 300M forging and is subjected to shear and bending loads.

axle is finished with ion vapor deposition (IVD) aluminum coating followed by epoxy primer and polyurethane paint coatings.

3. **DEFECTS.** Inspect brake attachment flange and flange radii for fatigue cracks. See figure 1, view A and section B. Primary suspect area is axle to brake assembly shoulder stud holes. See view C.

4. **PRIMARY INSPECTION METHOD.** Primary inspection method is magnetic particle.

5. **Personnel Qualifications.** Personnel doing this nondestructive inspection should be qualified and certified to do magnetic particle inspections per OPNAVINST 4790.2 SERIES, NDI Technicians, NEC 7225/MOS 6044.

### Support Equipment Required

#### NOTE

Alternate item type designations or part numbers are listed in parentheses.

Part Number or Type Designation	Nomenclature
DA200	Magnetic Inspection Probe
2480	Magnetic Particle Field Indicator
M-16 (ZB-26)	Black Light
—	5 to 14 X Pocket Magnifier

### Materials Required

#### NOTE

Alternate item part numbers are shown indented.

Specification or Part Number	Nomenclature
PD680TY2 D 1153	Dry Cleaning Solvent Methyl Isobutyl Ketone
14AM	Magnetic Inspection Compound
A-A-883, TYPE 1	Tape, Pressure Sensitive
A-A-1048-400	Aluminum Oxide Abrasive Paper
M83953-1, or -2,	Pencil, Aircraft Marking
CCCC46TY1CL4	Cloth, Cleaning

6. **Preparation of Aircraft.** Have aircraft prepared for jacking (A1-F18AC-LMM-000).

7. **Access.** Have multiple disk brake assembly removed (A1-F18AC-130-300, WP064 00). Have six axle to brake assembly studs, 74A411606, removed (A1-F18AC-130-300, WP041 00).

#### WARNING

Dry cleaning solvent and methyl isobutyl ketone are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

8. **Preparation of Part.** Clean inspection area with cleaning cloth moistened with dry cleaning solvent or methyl isobutyl ketone. This is to remove grease or other foreign material.

#### 9. Equipment Settings/Standardization/Setup.

Select magnetic inspection probe (probe) AC position and maximum current setting.

10. **Inspection Procedure.** Refer to WP006 00 and NAVAIR 01-1A-16, except as listed below:

#### CAUTION

Probe method of magnetization shall be used. Pass no current through parts to avoid possible arc burns.

a. Mask bearing surfaces with pressure sensitive tape. This is to protect them from inspection material.

b. Make darkened area for part inspection.

c. Position probe on axle at inspection position  
1. See figure 1, view D.

**WARNING**

Magnetic inspection compound may cause eye and skin irritation. Avoid contact with eyes, skin and clothing. Wash thoroughly after handling.

- d. Push test switch and immediately apply magnetic inspection compound.

**CAUTION**

Avoid overheating of probe. Do not exceed duty cycle. Duty cycle is 2 minutes on, 2 minutes off.

- e. Leave current on during application of inspection material and while inspecting.

- f. Using black light and 5 to 14 X magnifier, inspect for cracks on inner and outer flange surfaces and radii.

- g. Reposition probe for inspection position 2 through 8 by rotating probe 45° as shown. Repeat steps d through f until all positions are inspected.

- h. Mark location of defects with aircraft marking pencil and record.

- i. Demagnetize. Refer to WP006 00 and NAVAIR 01-1A-16.

- j. Reposition probe for second flux direction, inspection position 9, as shown in figure 1, view E, and repeat steps d through f.

- k. Rotate probe 30° for inspection positions 10 through 14 and repeat steps d through f until all positions are inspected.

- l. Mark location of defects with aircraft marking pencil and record.

- m. Clean inspection materials from part and demagnetize. Refer to WP006 00 and NAVAIR 01-1A-16.

**11. BACKUP INSPECTION METHOD.** Backup inspection method is fluorescent penetrant. Fluorescent penetrant may be used to verify indications detected by primary method.

**12. Personnel Qualifications.** Personnel doing this nondestructive inspection should be qualified and certified to do liquid penetrant inspections per OPNAVINST 4790.2 SERIES, NDI Technicians, NEC 7225/MOS 6044.

**Support Equipment Required****NOTE**

Alternate item type designations or part numbers are listed in parentheses.

Part Number or Type Designation	Nomenclature
ZA43 (TT10) (XMA101)	Portable Fluorescent Penetrant Inspection Kit
M-16 (ZB-26) —	Black Light 5 to 14 X Magnifier

**Materials Required****NOTE**

Alternate item part numbers are shown indented.

Specification or Part Number	Nomenclature
PD680TY2 D 1153	Dry Cleaning Solvent Methyl Isobutyl Ketone
A-A-1048-400	Aluminum Oxide Abrasive Paper
MILC85054TYPE1	Corrosion Preventative Compound
MP83953-1 or -2,	Pencil, Aircraft Marking
MILS83430CLASSB-1/2 CCCC46TY1CL4	Sealing Compound Cloth, Cleaning

**13. Preparation of Aircraft.** Same as primary method.

**14. Access.** Same as primary method.

**15. Preparation of Part.** Have axle, 74A410508, removed (A1-F18AC-130-300, WP041 00). Have paint stripped, NAVAIR 01-1A-509, and IVD coating removed from inspection zone. Use 400 grit abrasive cloth, stroking along length of crack indication, to remove IVD coating.

16. **Inspection Procedure.** Do a type I, method C fluorescent penetrant inspection (WP004 00) and NAVAIR 01-1A-16.

**17. POST INSPECTION CLEANING AND CORROSION CONTROL.**

**WARNING**

Dry cleaning solvent and methyl isobutyl ketone are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

a. Clean inspection materials from part with cleaning cloth moistened with dry cleaning solvent or methyl isobutyl ketone.

b. Restore finish system as below:

(1) Parts with confirmed cracks shall have unpainted surfaces coated with corrosion prevention compound.

(2) For good parts, apply two coats of MMS-425 primer (A1-F18AC-SRM-500, WP011 00).

**WARNING**

Sealing compound is flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

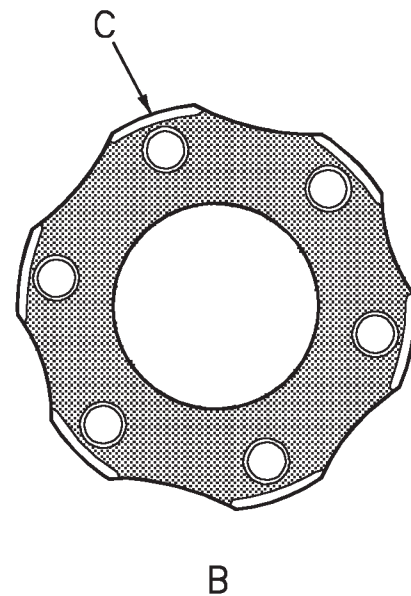
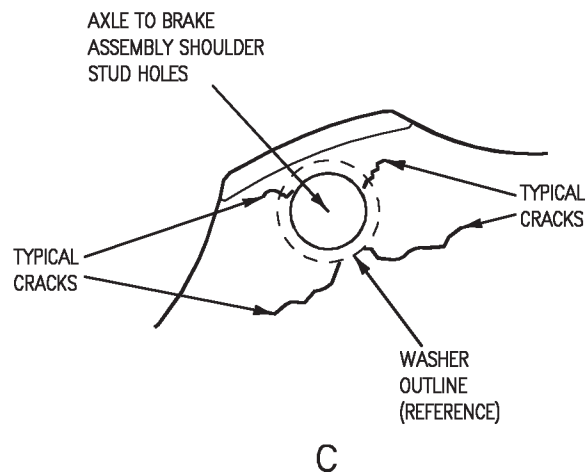
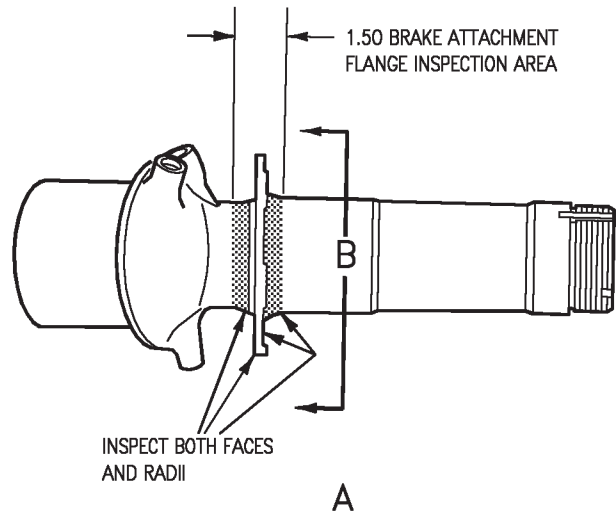
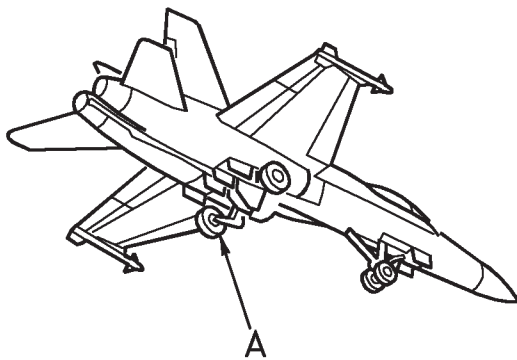
(3) Apply one coat, brush or spray, sealing compound (A1-F18AC-SRM-500, WP010 00).

(4) Apply final finish, refer to special area finish requirements (A1-F18AC-SRM-500, WP012 00).

**18. SYSTEM SECURING.**

a. Have axle, 74A410508, and six axle to brake assembly studs, 74A411606, reinstalled (A1-F18AC-130-300, WP041 00).

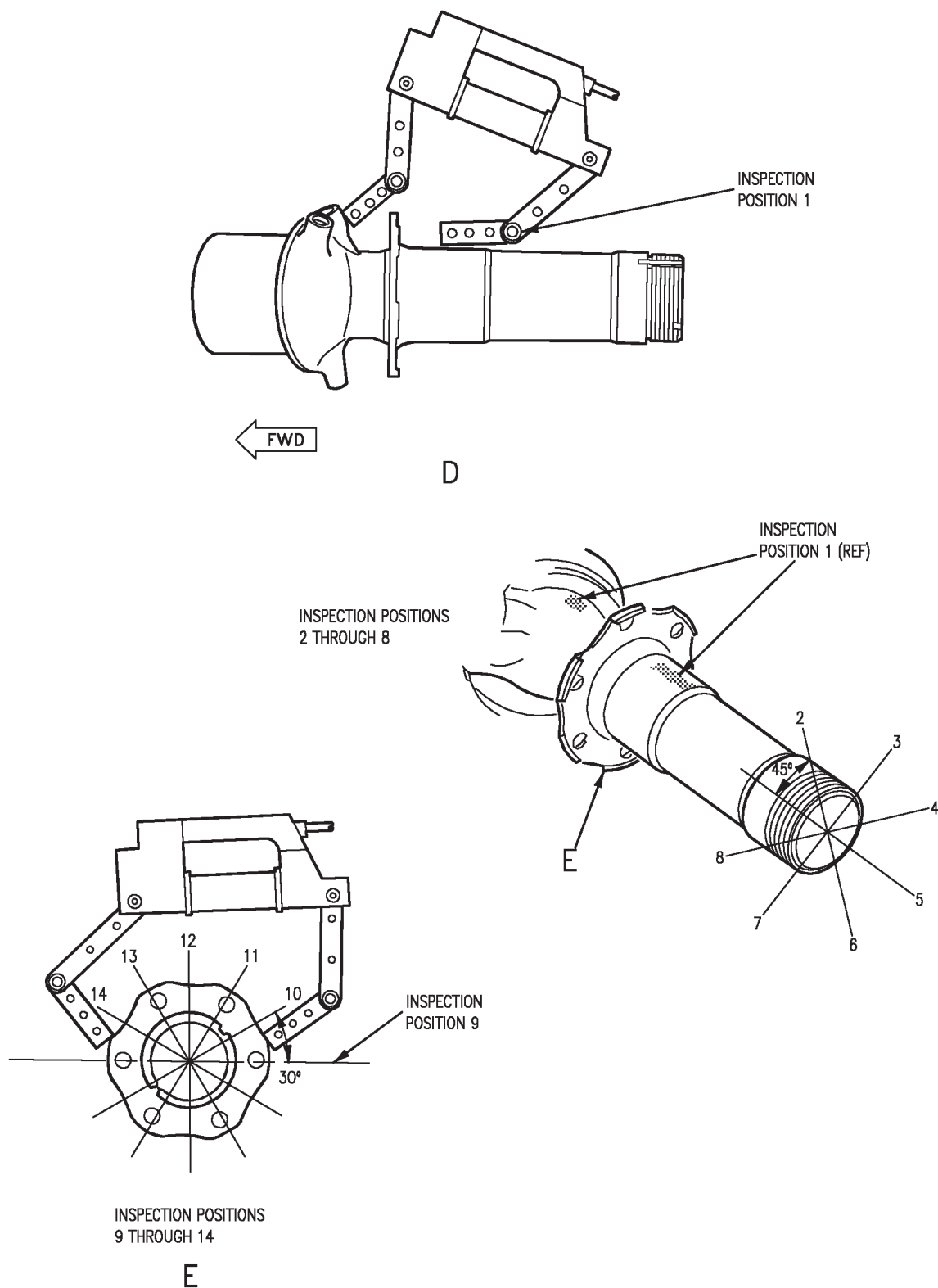
b. Have multiple disk brake assembly and wheel and tire assembly reinstalled (A1-F18AC-130-300, WP064 00).



## LEGEND



Figure 1. Main Landing Gear Axle, Cracks (Sheet 1)



**Figure 1. Main Landing Gear Axle, Cracks (Sheet 2)**



## INTERMEDIATE MAINTENANCE

## NONDESTRUCTIVE INSPECTION

## MAGNETIC PARTICLE INSPECTION OF THE MAIN LANDING GEAR AXLE

## IN THE POLYGON AREA

## PART NO. 74A410509

## Reference Material

Naval Aviation Maintenance Program .....	OPNAVINST 4790.2
Plane Captain Manual .....	A1-F18AC-PCM-000
Nondestructive Inspection Methods .....	NAVAIR 01-1A-16
Nondestructive Inspection.....	A1-F18AC-SRM-300
Magnetic Particle Method.....	WP006 00
Line Maintenance Procedures.....	A1-F18AC-LMM-000

## Alphabetical Index

Subject	Page No.
Introduction .....	1
Main Landing Gear Axle .....	1
Access.....	2
Documentation of Results.....	3
Magnetic Particle Inspection.....	2
Materials Required .....	2
Personnel Qualifications .....	2
Preparation of Aircraft.....	2
Preparation of Part.....	2
Safety Requirements .....	1
Support Equipment Required.....	2

## Record of Applicable Technical Directives

None

## 1. INTRODUCTION.

2. This work package defines the safety requirements, support equipment required, materials required, standardization, and inspection procedure using a DA-200 magnetic particle inspection probe. The following is a procedure for inspecting the main landing gear (MLG) axle in the polygon area.

## 3. MAIN LANDING GEAR AXLE.

4. The MLG axle (74A410509) is made from austenized, quenched, and tempered 300M steel. The area of inspection is plated with a layer of electrolyze nickel approximately 0.002 inch thick.

5. **SAFETY REQUIREMENTS.** Make sure safety requirements have been met before using electrical

equipment near aircraft fuel cells, oxygen systems and stores (A1-F18AC-PCM-000).

**6. PERSONNEL QUALIFICATIONS.** Personnel doing this nondestructive inspection shall be qualified and certified to do magnetic particle inspections per OPNAVINST 4790.2 SERIES, NDI Technicians, NEC 7225/MOS 6044.

### Support Equipment Required

#### NOTE

Any magnetic particle probe may be used with this procedure provided it is able to produce a DC field not less than 85 % of the DA200's maximum, has adjustable legs, and can be set up in a method similar to Magnetic Particle Inspection, this WP.

#### Part Number or Type Designation

#### Nomenclature

DA-200	Magnetic Particle Inspection Probe
J-221	Ultraviolet Meter
B-14N	Black Light, Portable, Magnetic Particle/ Penetrant

### Materials Required

#### Specification or Part Number

#### Nomenclature

P-D-680TY2 (CAGE 81348)	Dry Cleaning Solvent
14AM or equivalent	Fluorescent Magnetic Particle Compound
673-T (CAGE 05360)	Marker, Tube Type
CCC-C-46 TY1CL4 (CAGE 80244)	Cloth, Cleaning

**7. PREPARATION OF AIRCRAFT.** Have aircraft prepared for jacking (A1-F18AC-LMM-000).

**8. ACCESS.** The MLG axle assembly shall be removed per the associated Service Bulletin.

### 9. PREPARATION OF PART.

a. The nickel plating in the inspection areas shall be removed.

b. Locate the inspection area shown in figure 1 and visually inspect the applicable surfaces.

#### WARNING

Dry cleaning solvent is flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

c. Clean all foreign matter, grease and oil from the inspection area using a cleaning cloth moistened with dry cleaning solvent.

**10. MAGNETIC PARTICLE INSPECTION.** Refer to NAVAIR 01-1A-16 for inspection area lighting requirements and (WP006 00) to test for correct probe operation.

#### CAUTION

Probe method of magnetization shall be used. Pass no current through parts to avoid possible arc burns.

a. Set AC/DC switch to DC.

b. Set probe to maximum current setting.

c. Position MLG axle so as that magnetic inspection compound will not collect in the inspection area.

d. Position probe on the edge of the axle as shown in figure 2.

e. Push test switch and immediately apply magnetic inspection compound.



Avoid overheating of probe. Do not exceed duty cycle. Duty cycle is 2 minutes on, 2 minutes off.

f. Leave current on during application of inspection material and while inspecting.

g. Using black light, inspect for cracks. Cracks may be contained within the inspection area or may be starting in the inspection area and going into the polygon surface. The polygon surface has not had the nickel plating removed.

h. Repeat step d through f for each corner of the polygon.

i. Demagnetize axle. Refer to (WP006 00).



Dry cleaning solvent are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

j. Clean inspection compound off of axle using dry cleaning solvent.

## 11. DOCUMENTATION OF RESULTS.

a. If no cracks are found, record that this inspection was completed in the aircraft maintenance log and the axle SRC card.

b. If cracks are found, map the location and provide dimensions on an illustration similar to figure 3. Complete documentation sheet, attach it and VIDS/MAF to the SRC card and submit to the Maintenance Control Office.

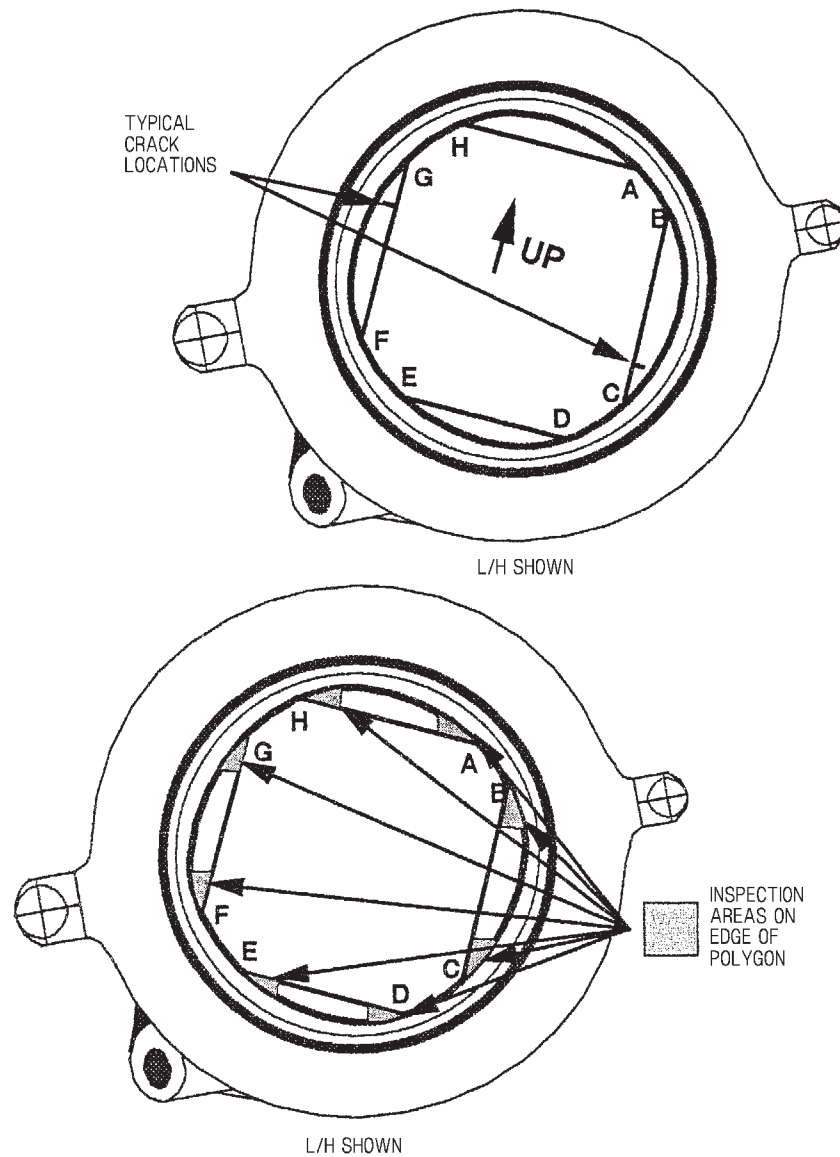
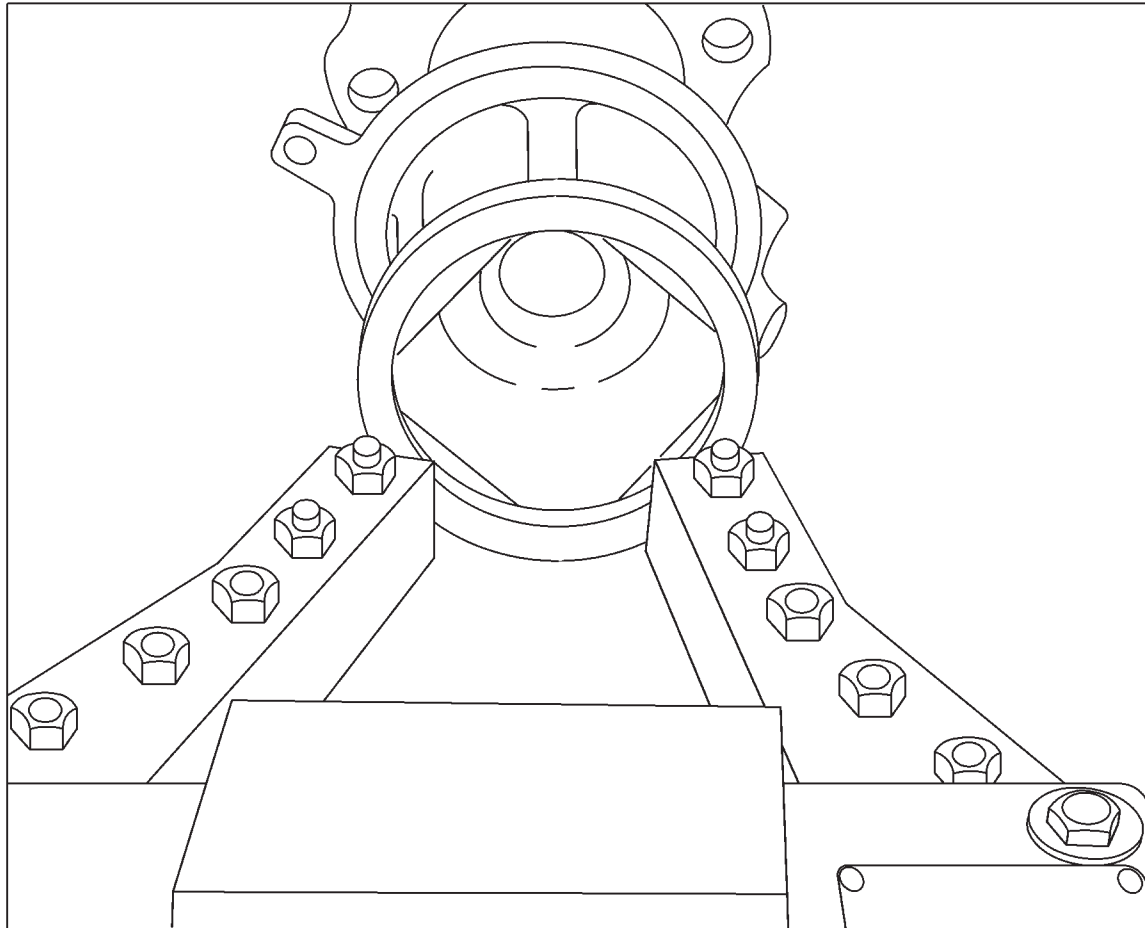
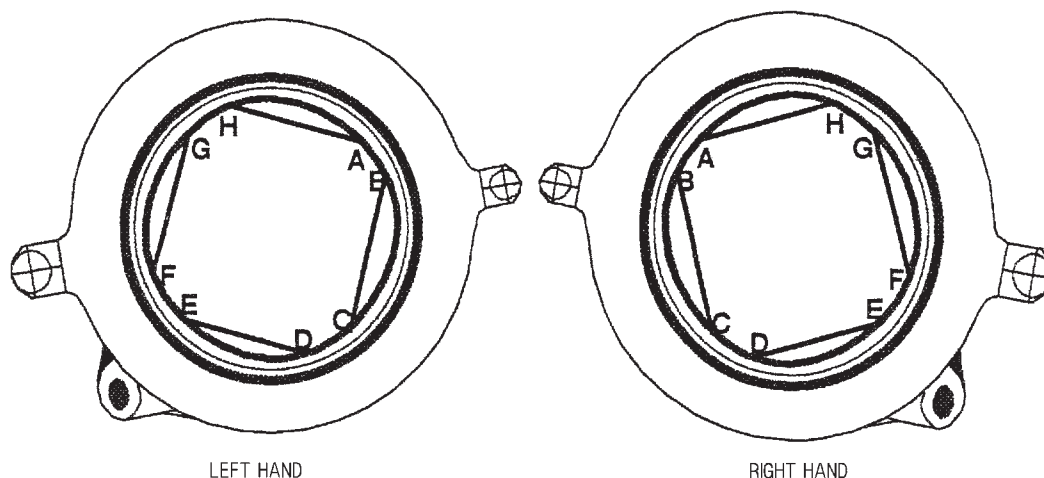


Figure 1. Inspection Area



**Figure 2. Positioning of Probe for Shots**



INDICATE CRACK LOCATION AND LENGTH

BUNO: \_\_\_\_\_ DATE: \_\_\_\_\_ LOCATION: \_\_\_\_\_

SQDN: \_\_\_\_\_ INSPECTOR: \_\_\_\_\_ PHONE NO. \_\_\_\_\_

O-LEVEL PLEASE COMPLETE THE FOLLOWING INFORMATION PRIOR TO DELIVERY OF AXLE TO I-LEVEL:

1. MAIN LANDING GEAR AXLE

P/N 74A410509 – \_\_\_\_\_ S/N \_\_\_\_\_

(NOTE: P/N & S/N ARE IMPRESSION STAMPED ON THE EDGE OF THE FLANGE)

2. MAIN LANDING GEAR AXLE/LEVER ASSEMBLY

P/N 74A410506 – \_\_\_\_\_ S/N \_\_\_\_\_

(NOTE: P/N & S/N ARE IMPRESSION STAMPED ON THE OUT'B SIDE OF THE PLANNING LINK CLEVIS)

3. CRANK ASSEMBLY

P/N 74A410555 – \_\_\_\_\_ S/N \_\_\_\_\_

TOTAL NO. OF AXLE LANDINGS: FIELD \_\_\_\_\_ FCLP \_\_\_\_\_ CV \_\_\_\_\_

TOTAL AXLE MMP 903 CODES \_\_\_\_\_ TOTAL AXLE MMP 904 CODES \_\_\_\_\_

## INTERMEDIATE MAINTENANCE

## NONDESTRUCTIVE INSPECTION

## MAIN LANDING GEAR TRUNNION CRACKS

PART NO. 74A410511

This WP supersedes WP069 00, dated 1 April 1993.

## Reference Material

Naval Aviation Maintenance Program .....	OPNAVINST 4790.2
Plane Captain Manual .....	A1-F18AC-PCM-000
Nondestructive Inspection.....	A1-F18AC-SRM-300
Pulse-Echo, Longitudinal Wave Contact, Without Delay Line, of Metallic Materials .....	WP008 05
Pulse-Echo Shear Wave, Angle Beam, Contact of Metallic Materials .....	WP008 14

## Alphabetical Index

Subject	Page No.
Main Landing Gear Trunnion.....	1
Defects .....	1
Post Inspection Cleaning and Corrosion Control.....	5
Primary Inspection Method .....	1
Ultrasonic Method Using C-398 Ultrasonic Flaw Detector .....	2
Ultrasonic Method Using MXU-715/E Ultrasonic Flaw Detector .....	4

## Record of Applicable Technical Directives

None

## 1. MAIN LANDING GEAR TRUNNION.

2. Main landing gear trunnion (trunnion) is machined 300M steel forging. External surface is IVD aluminum coated or cadmium plated. Finish system is epoxy primer and enamel topcoat. Internal surface is coated with epoxy primer and thin layer of sealant.

3. **DEFECTS.** Inspect for internal cracks located in upper inboard area of trunnion. Cracks are approximately 4.5 inches from center of outboard web and run parallel to web. See figure 1.

4. **PRIMARY INSPECTION METHOD.** Primary inspection method is ultrasonic.

5. **Personnel Qualifications.** Personnel doing this nondestructive inspection should be qualified and certified to do ultrasonic inspections per OPNAVINST 4790.2 SERIES, NDI Technicians, NEC 7225/MOS 6044.

6. **Preparation of Aircraft.** No special preparation required.

7. **Access.** No special access required.

## 8. ULTRASONIC METHOD USING C-398 ULTRASONIC FLAW DETECTOR.

### Support Equipment Required

#### NOTE

Alternate item type designations or part numbers are listed in parentheses.

Part Number or Type Designation	Nomenclature
C-398	Ultrasonic Flaw Detector
57A2271 or EQUIVALENT	Microdot to BNC Connecting Cable
57A3052 or EQUIVALENT	45°, 0.250 X 0.250 Inch 5 MHz, Contact Search Unit
74D110007-1001 (74SB2462)	Ultrasonic Reference Standard for MLG Lever

### Materials Required

Specification or Part Number	Nomenclature
ULTRAGEL II M83953-1 or -2	Ultrasonic Couplant Pencil, Aircraft Marking
020X413	Cleaning Compound
CCCC46TY1CL4	Cleaning Cloth
-	Clear Tape

#### WARNING

Cleaning compound is a flammable liquid and vapor. May cause allergic respiratory and skin reaction. May cause eye, skin and respiratory irritation. Keep away from heat, sparks, and flame. Do not breathe dust (vapor, mist, gas). Use only with adequate ventilation. Keep container closed. Avoid contact with eyes, skin and clothing. Wash thoroughly after handling.

9. **Preparation of Part.** Clean inspection area of contamination or foreign material using cleaning

cloth moistened with cleaning compound. Allow to air dry 15 minutes. See figure 2

## 10. Equipment Settings/Standardization/Setup.

#### WARNING

Make sure safety precautions have been met for electrical, static, grounding when using ultrasonic equipment near aircraft fuel cells, oxygen systems, electrical systems, and stores (A1-F18AC-PCM-000).

a. Do Equipment Settings/Standardization/Setup (WP008 05), except as below:

#### NOTE

Tester settings listed here are given as initial setup guide. Equipment differences may require use of alternate REP. RATE, DAMP., FREQ., GAIN, REJECT, SWEEP DELAY, and SWEEP LENGTH.

COARSE SWEEP DELAY.....	0 - 3 INCHES
FINE GAIN.....	MID SCALE
COARSE GAIN .....	4 (APPROX)
FINE SWEEP RANGE.....	MID SCALE
COARSE SWEEP RANGE.....	2.0 INCHES
ATTENUATORS .....	2, 4, 8, 16, IN 32 OUT

#### WARNING

Couplant may cause eye irritation. Avoid contact with eyes. Wash thoroughly after handling.

b. Apply couplant to MLG reference standard 0.60 inches from EDM notch.

c. Position front edge of search unit 0.60 inch from EDM notch. See figure 3.

d. For best EDM notch response, swivel and move search unit toward or away from EDM notch.



Do not move search unit more than 0.20 inch from original position. It is required to have two full skips of sound beam to establish metal travel distance for inspection.

e. Verify notch response by moving search unit to one side of notch. Notch response will disappear and reference standard edge response(s) will remain. Be sure excess couplant is removed between search unit and notch as this may cause false indications.

### NOTE

GAIN may be adjusted by changing FINE GAIN, COARSE GAIN, or by toggling ATTENUATORS.

f. Adjust GAIN to set notch response amplitude at 50 percent CRT height.

g. Adjust SWEEP RANGE to set response at 5 on horizontal baseline, see figure 4, CRT 1.

h. For the 74SB2462 reference standard add maximum of 6 dB GAIN and verify if amplitude of notch response increases. For 74D110007- 1001 reference standard add 14dB GAIN and verify if amplitude of notch response increases.

i. Apply clear tape to filter covering CRT and draw reject line on CRT at 50 percent CRT height from 3 to 7 on CRT horizontal baseline using aircraft marking pencil. Crack responses will occur in this range. See figure 4, CRT 2.

### NOTE

Conventional distance amplitude correction (DAC) curve cannot be used for this inspection because crack responses will increase and decrease too quickly during scan.

## 11. Inspection Procedure.

a. Use aircraft marking pencil to draw 1.00 X 1.00 inch square on inboard trunnion with two sides parallel to outboard web defining inspection area. See figure 2. Center point of back line of square is 6.00 inches from outboard web and 8.00 inches from bulkhead next to bottom of outboard trunnion post.

b. Apply couplant to inspection area.

c. Position front end of search unit on back line of inspection area and facing web.

### NOTE

Failure to remove excess couplant, scanning outside inspection area, or swiveling search unit greater than 20 degrees may result in false indications.

d. Scan toward web, swiveling search unit approximately 20 degrees to each side, see figure 5.

e. Remove any excess couplant.

f. Scan all inspection area using 0.10 inch index for search units. Keep front edge of search unit inside of inspection area.

g. Mark search unit position using aircraft marking pencil on trunnion surface for crack response exceeding rejection line, see figure 4, CRT 2.

h. Record defects.

i. Do paragraph 16.

## 12. ULTRASONIC METHOD USING MXU-715/E ULTRASONIC FLAW DETECTOR.

### Support Equipment Required

Part Number or Type Designation	Nomenclature
1642AS100-1	Ultrasonic Flaw Detector, MXU-715/E, Magnaflux
57A2271 or EQUIVALENT 57A3052 or EQUIVALENT	Microdot to BNC Connecting Cable 45°, 0.250 X 0.250 Inch 5 MHz, Contact Search Unit
74D110007-1001 (74SB2462)	Ultrasonic Reference Standard for MLG Lever

### Materials Required

Specification or Part Number	Nomenclature
ULTRAGEL II M83953-1 or -2	Ultrasonic Couplant Pencil, Aircraft Marking
020X413	Cleaning Compound
CCCC46TY1CL4	Cleaning Cloth
-	Clear Tape

### WARNING

Cleaning compound is a flammable liquid and vapor. May cause allergic respiratory and skin reaction. May cause eye, skin and respiratory irritation. Keep away from heat, sparks, and flame. Do not breathe dust (vapor, mist, gas). Use only with adequate ventilation. Keep container closed. Avoid contact with eyes, skin and clothing. Wash thoroughly after handling.

13. **Preparation of Part.** Clean inspection area of contamination or foreign material using cleaning cloth moistened with cleaning compound. Allow to air dry for 15 minutes. See figure 2.

## 14. Equipment Settings/Standardization/Setup.

### WARNING

Make sure safety precautions have been met for electrical, static, grounding when using ultrasonic equipment near aircraft fuel cells, oxygen systems, electrical systems, and stores (A1-F18AC-PCM-000).

a. Do Equipment Settings/Standardization/Setup (WP008 14), except as below:

### NOTE

Tester settings listed here are given as initial setup guide. Equipment differences may require use of alternate REP. RATE, DAMP., FREQ., GAIN, REJECT, and HORIZONTAL SWEEP DELAY and LENGTH.

GAIN (dB).....	60 (dB)
COURSE GAIN .....	6
FINE GAIN.....	0
HORIZONTAL SWEEP LENGTH	
COURSE.....	2
FINE.....	9

### WARNING

Couplant may cause eye irritation. Avoid contact with eyes. Wash thoroughly after handling.

b. Apply couplant to MLG reference standard 0.60 inches from EDM notch.

c. Position front edge of search unit 0.60 inch from EDM notch. See figure 3.

d. For best EDM notch response swivel moving search unit toward or away from EDM notch. Do not move search unit more than 0.20 inch from original position. It is required to have two full skips of sound beam to establish metal travel distance for inspection.

e. Verify notch response by moving search unit to one side of notch. Notch response will disappear and reference standard edge response(s) will remain. Be sure excess couplant is removed between search unit and notch as this may cause false indications.

f. Adjust GAIN to set notch response amplitude at 50 percent CRT height.

g. Adjust HORIZONTAL SWEEP LENGTH to set response at 5 on horizontal baseline, see figure 4, CRT 1.

h. For the 74SB2462 reference standard add maximum of 6 dB GAIN and verify if amplitude of notch response increases. For 74D110007- 1001 reference standard add 14dB GAIN and verify if amplitude of notch response increases.

i. Apply clear tape to filter covering CRT and draw reject line on CRT at 50 percent CRT height from 3 to 7 on CRT horizontal baseline using aircraft marking pencil. Crack responses will occur in this range. See figure 4, CRT 2.

### NOTE

Conventional distance amplitude correction (DAC) curve cannot be used for this inspection, because crack responses will increase and decrease too quickly during scan.

#### 15. Inspection Procedure.

a. Use aircraft marking pencil to draw 1.00 X 1.00 inch square on inboard trunnion with two sides parallel to outboard web defining inspection area. See figure 2. Center point of back line of square is 6.00 inches from outboard web and 8.00 inches from bulkhead next to bottom of outboard trunnion post.

b. Apply couplant to inspection area.

c. Position front end of search unit on back line of inspection area and facing web.

### NOTE

Failure to remove excess couplant, scanning outside inspection area, or swiveling search unit greater than 20 degrees may result in false indications.

d. Scan toward web, swiveling search unit approximately 20 degrees to each side, see figure 5.

e. Remove any excess couplant.

f. Scan all inspection area using 0.10 inch index for search units. Keep front edge of search unit inside of inspection area.

g. Mark search unit position using aircraft marking pencil on trunnion surface for crack response exceeding rejection line, see figure 4, CRT 2.

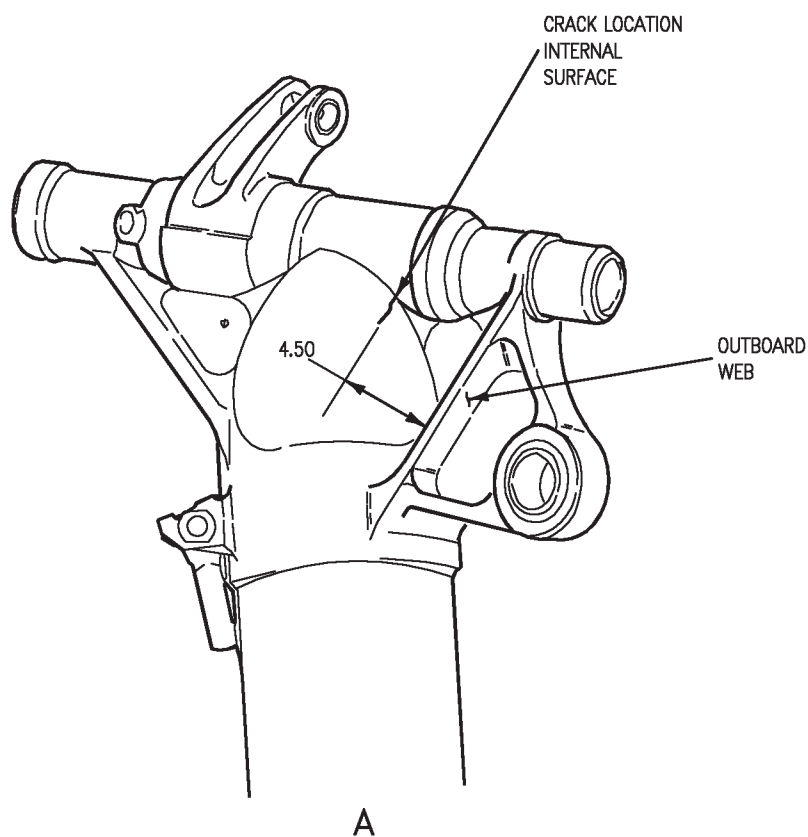
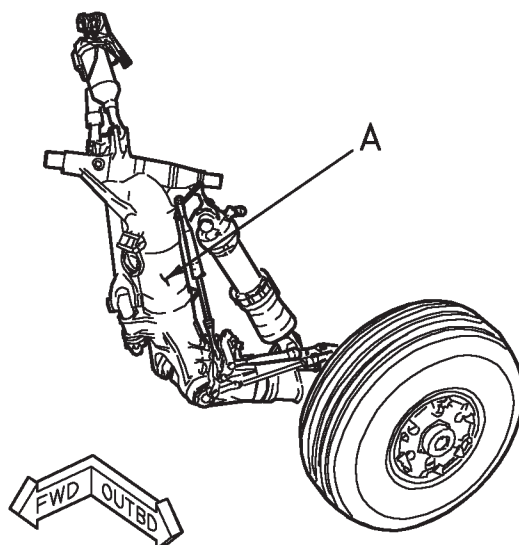
h. Record defects.

#### 16. POST INSPECTION CLEANING AND CORROSION CONTROL.

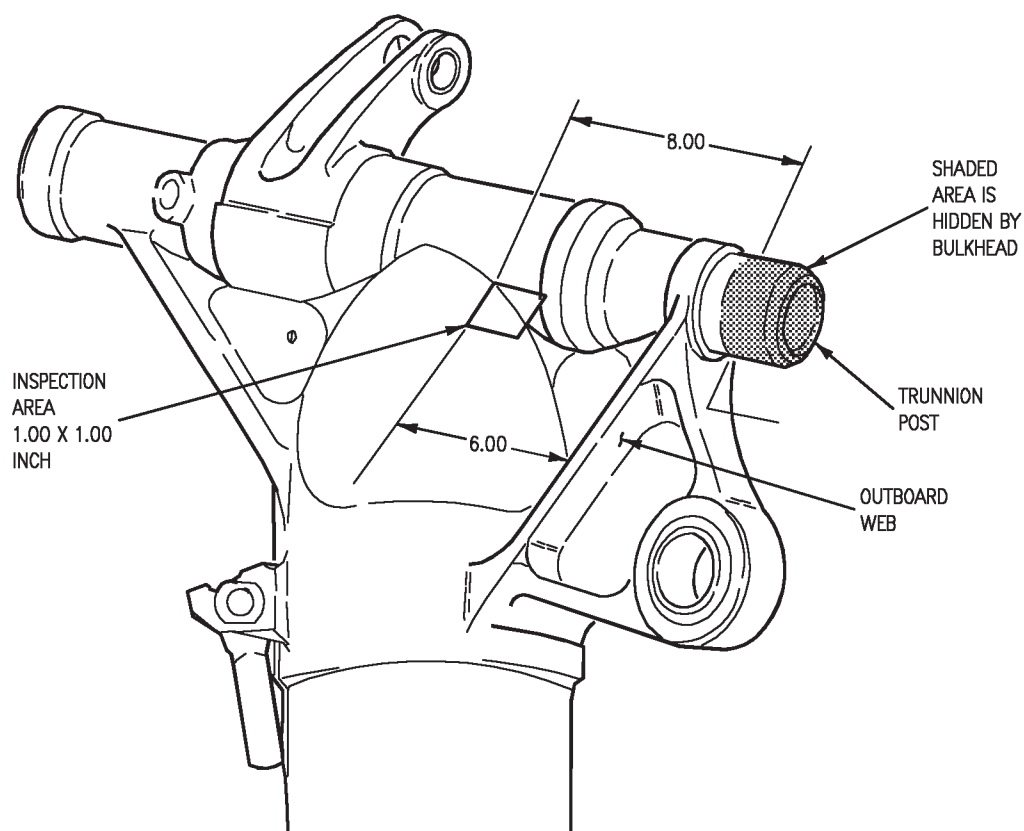
### WARNING

Cleaning compound is a flammable liquid and vapor. May cause allergic respiratory and skin reaction. May cause eye, skin and respiratory irritation. Keep away from heat, sparks, and flame. Do not breathe dust (vapor, mist, gas). Use only with adequate ventilation. Keep container closed. Avoid contact with eyes, skin and clothing. Wash thoroughly after handling.

a. Clean inspection marks, inspection area outline, and couplant from trunnion using cleaning cloth moistened with cleaning compound. Allow to air dry 15 minutes.



**Figure 1. Upper Inboard Area of Main Landing Gear Trunnion**

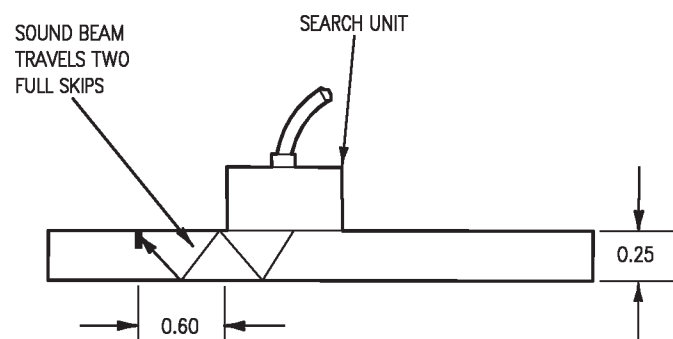
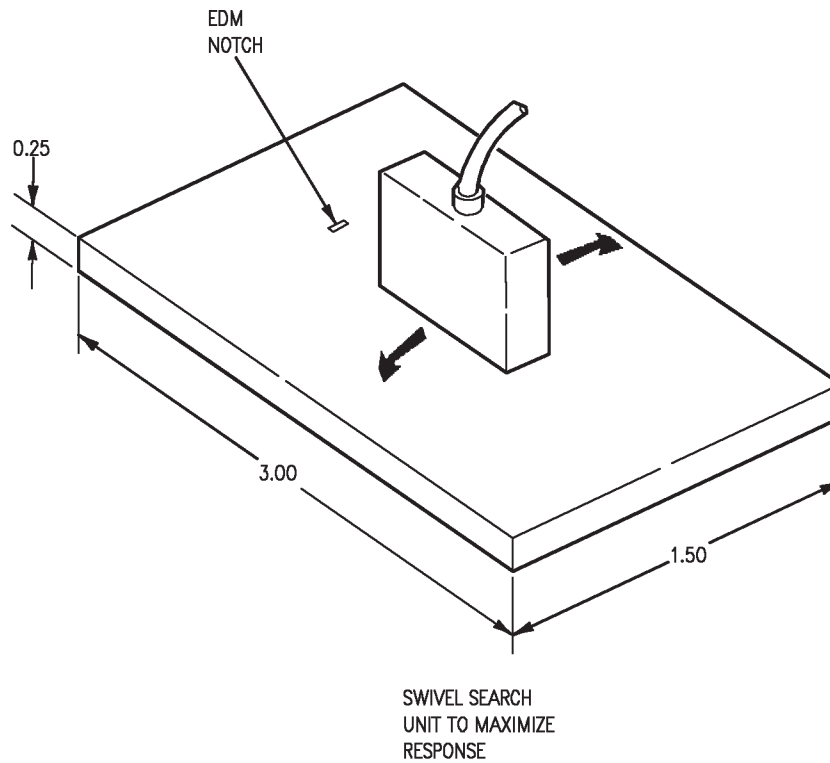


## LEGEND

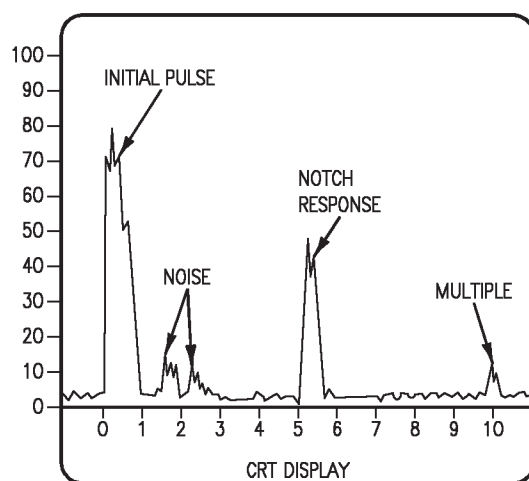


SHADED AREA IS  
HIDDEN BY BULKHEAD.

**Figure 2. Main Landing Gear Trunnion Inspection Area**

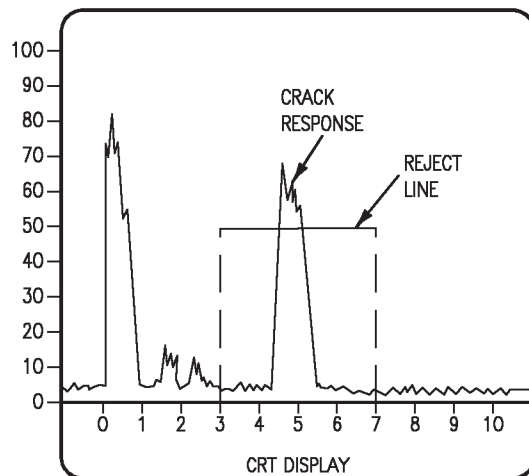


**Figure 3. Ultrasonic Reference Standard**



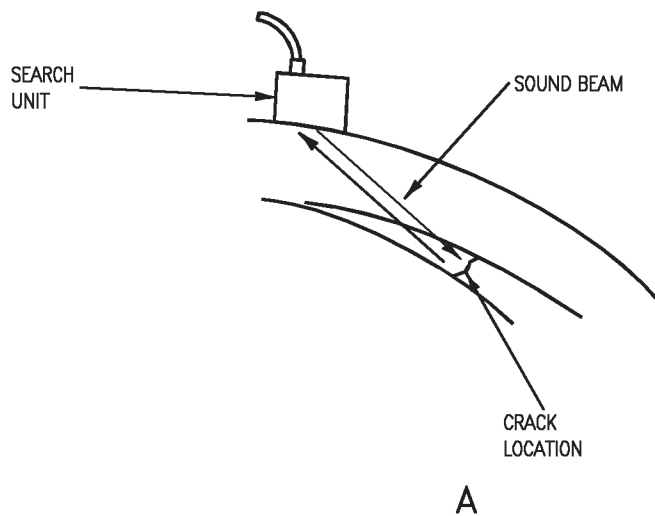
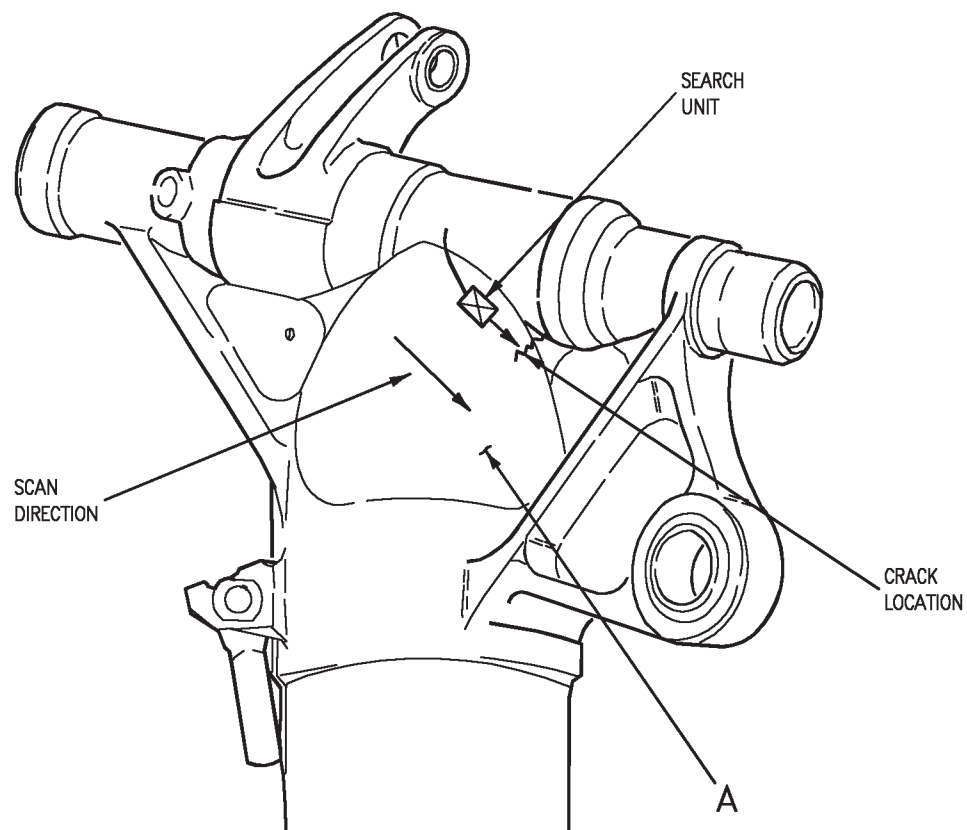
REFERENCE STANDARD EDGE  
RESPONSE MAY ALSO BE  
VISIBLE.

**CRT 1**  
**REFERENCE STANDARD SETUP**



**CRT 2**  
**REJECTABLE CRACK RESPONSE**  
**AFTER ADDING 6 DB OF GAIN**

**Figure 4. Standardization**



**Figure 5. Ultrasonic Scan**



## INTERMEDIATE MAINTENANCE

## NONDESTRUCTIVE INSPECTION

## MAIN LANDING GEAR TRUNNION, LOWER SECTION, CRACKS

PART NO. 74A410511

This WP supersedes WP069 01, dated 15 December 1992.

## Reference Material

Naval Aviation Maintenance Program .....	OPNAVINST 4790.2
Aircraft Corrosion Control.....	A1-F18AC-SRM-500
Landing Gear, Arresting Hook, And Launch Bar, Finish System And Markings.....	WP042 00
Landing Gear and Related Systems.....	A1-F18AC-130-300
MLG Trunnion Assembly (12MAP585 or 12MAR586).....	WP037 00
Aircraft Weapons Systems Cleaning And Corrosion Control.....	NAVAIR 01-1A-509
Nondestructive Inspection.....	A1-F18AC-SRM-300
Main Landing Gear Trunnion Lower Section, Crack Verification.....	WP069 02
Magnetic Particle Method.....	WP006 00

## Alphabetical Index

Subject	Page No.
Main Landing Gear Trunnion.....	1
Defects .....	1
Post Inspection Cleaning and Corrosion Control.....	4
Primary Inspection Method .....	1
System Securing.....	4

## Record of Applicable Technical Directives

None

## 1. MAIN LANDING GEAR TRUNNION.

2. Main landing gear trunnion (trunnion) is machined 300 M steel forging. External surface is IVD, aluminum, coated or cadmium plated. Finish system is epoxy primer and enamel topcoat. Internal surface is coated with epoxy primer and thin layer of sealant.

3. **DEFECTS.** Inspect for cracks on lower section of main landing gear trunnion. Cracks will be found in 3 X 3 inch inspection area shown in figure 1.

4. **PRIMARY INSPECTION METHOD.** Primary inspection method is magnetic particle.

5. **Personnel Qualifications.** Personnel doing this nondestructive inspection should be qualified and certified to do magnetic particle inspections per

OPNAVINST 4790.2 SERIES, NDI Technicians,  
NEC 7225/MOS 6044.

6. **Preparation of Aircraft.** No special preparation required.

7. **Access.** No special access required.

### Support Equipment Required

#### NOTE

Alternate item type designations or part numbers are listed in parentheses.

Part Number or Type Designation	Nomenclature
DA200	Magnetic Inspection Probe
2480	Magnetic Particle Field Indicator
M-16 (ZB-26) J-60 (92957)	Black Light, Portable, Parker Magnetic Probe Adapter
J-221	Ultraviolet Meter

### Materials Required

Specification or Part Number	Nomenclature
14AM	Magnetic Inspection Compound
020X413	Cleaning Compound
M83953-1, or -2	Pencil, Aircraft Marking
MILC87962TYPE1	Cloth, Cleaning
MILR81294	Remover, Paint
MILB121TY1GRACL1	Barrier Material
MILT22085TY1	Tape, Pressure Sensitive

#### 8. Preparation of Part.

a. Preparation of part when not using magnetic probe adapter:

(1) Have electrical wire cable unclamped and tied back clear of inspection area (A1-F18AC-130-300, WP037 00).

(2) Have emergency brake line, smaller diameter tube, removed (A1-F18AC-130-300, WP037 00).

#### WARNING

Cleaning compound is flammable liquid and vapor. May cause allergic respiratory and skin reaction. May cause eye, skin and respiratory irritation. Keep away from heat, sparks, and flame. Do not breathe dust (vapor, mist, gas). Use only with adequate ventilation. Keep container closed. Avoid contact with eyes, skin and clothing. Wash thoroughly after handling.

(3) Clean trunnion area of any contamination or foreign material using cleaning cloth moistened with cleaning compound. Allow surface to air dry 15 minutes.

(4) Mark 3 X 3 inch inspection area on trunnion using end of bellcrank attach lug runout as its center as shown in figure 1.

(5) Mask area surrounding inspection areas using pressure sensitive tape and barrier material.

#### WARNING

Paint remover is flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

#### CAUTION

Make sure paint remover does not contact surrounding area(s) of trunnion, damage to finish system may result.

(6) Have finish system removed from inspection area using paint remover (NAVAIR 01-1A-509).

b. Preparation of part when using magnetic probe adapter:

(1) Have electrical wire cable unclamped and tied back clear of inspection area.

**WARNING**

Cleaning compound is flammable liquid and vapor. May cause allergic respiratory and skin reaction. May cause eye, skin and respiratory irritation. Keep away from heat, sparks, and flame. Do not breathe dust (vapor, mist, gas). Use only with adequate ventilation. Keep container closed. Avoid contact with eyes, skin and clothing. Wash thoroughly after handling.

**NOTE**

Do not remove emergency brake line when using magnetic probe adapter.

(2) Clean trunnion area of any contamination or foreign material using cleaning cloth moistened with cleaning compound. Allow surface to air dry 15 minutes.

(3) Mark 3 X 3 inch inspection area on trunnion using end of bellcrank attach lug runout as its center as shown on figure 1.

(4) Mask area surrounding inspection areas using pressure sensitive tape and barrier material.

**WARNING**

Paint remover is flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

**CAUTION**

Make sure paint remover does not contact surrounding area(s) of trunnion, damage to finish system may result.

(5) Have finish system removed from inspection area using paint remover (NAVAIR 01-1A-509).

### 9. Equipment Settings/Standardization/Setup For Longitudinal Magnetization Using Electromagnetic Probe.

**NOTE**

Direct current (DC) is recommended for all magnetic particle inspections specially when detection of flaws not open to surface is required.

a. Set AC/DC switch to DC.

b. Adjust magnetization intensity control to MAXIMUM.

c. Probe operation and sensitivity. Do Equipment Settings/Standardization/ Setup for Longitudinal Magnetization Using Probe and figure 2 (WP006 00).

### 10. Inspection Procedure. Do Inspection Procedure For True Continuous Longitudinal Magnetization Using Probe except for:

a. Darkened area for inspection.

b. Position probe at position 1 shown in figure 2.

**WARNING**

Magnetic inspection compound may cause eye and skin irritation. Avoid contact with eyes, skin and clothing. Wash thoroughly after handling.

**CAUTION**

Duty cycle for probe is 2 minutes on, 2 minutes off. Coil cover heating is indication of excessive on time.

c. Press ON to magnetize trunnion and immediately apply magnetic inspection compound to inspection area.

d. Inspect complete inspection area(s) for cracks, use black light.

e. Mark location of any crack indications using aircraft marking pencil and record.

f. Position probe at position 2 as shown on figure 2.

g. Repeat steps c, d, and e above.

h. Demagnetize inspection and surrounding area, Demagnetization (WP006 00).

i. If no crack indication(s) is found, do paragraphs 11 and 12.

j. If crack indication(s) is found do (WP069 02).

### 11. POST INSPECTION CLEANING AND CORROSION CONTROL.

#### WARNING

Cleaning compound is flammable liquid and vapor. May cause allergic respiratory and skin reaction. May cause eye, skin and respiratory irritation. Keep away from heat, sparks, and flame. Do not breathe dust (vapor, mist, gas). Use only with adequate ventilation. Keep container closed. Avoid contact with eyes, skin and clothing. Wash thoroughly after handling.

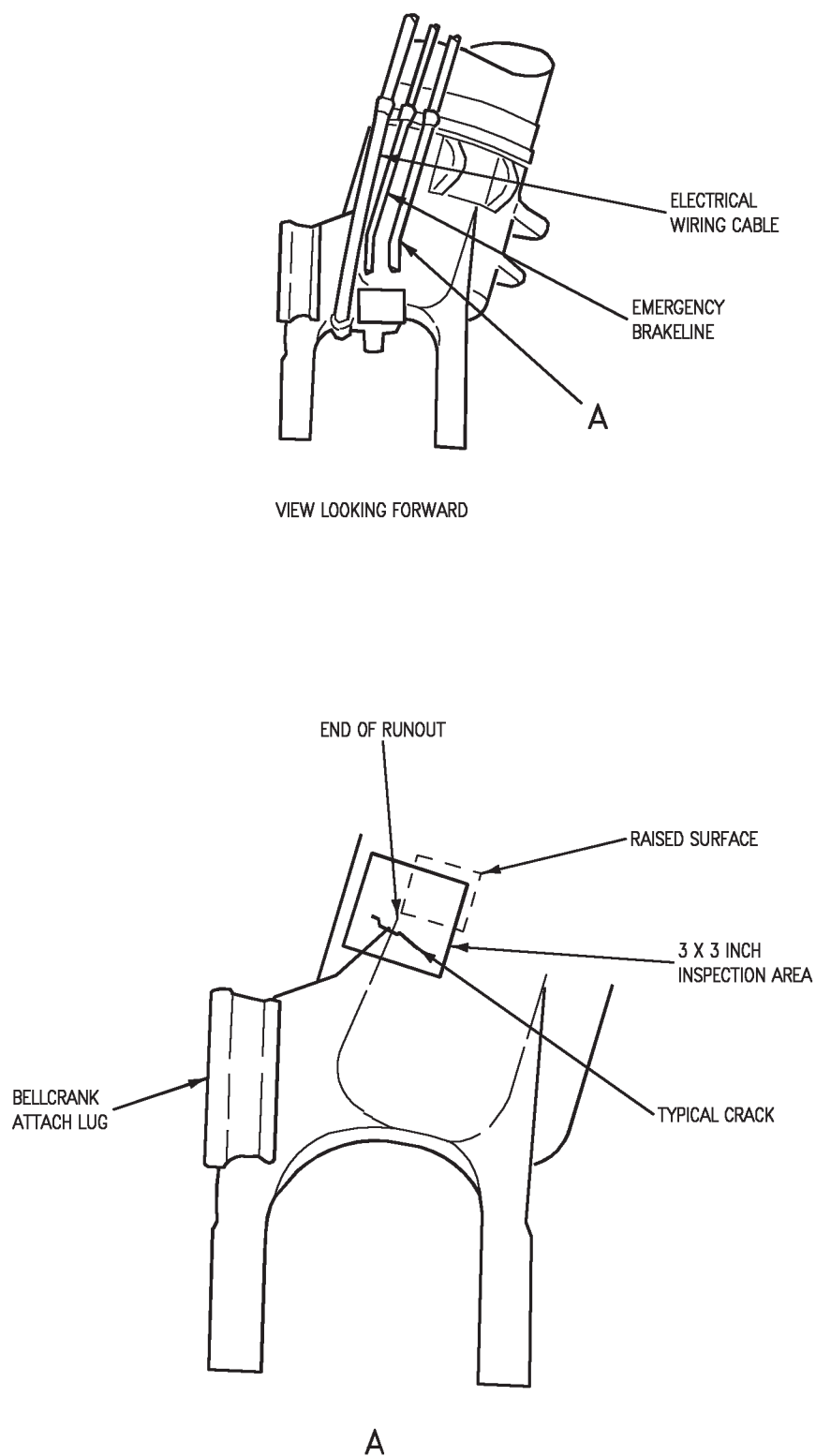
a. Clean inspection materials and marks from trunnion using cleaning cloth moistened with cleaning compound.

b. Refinish inspection area (A1-F18AC-SRM-500, WP042 00).

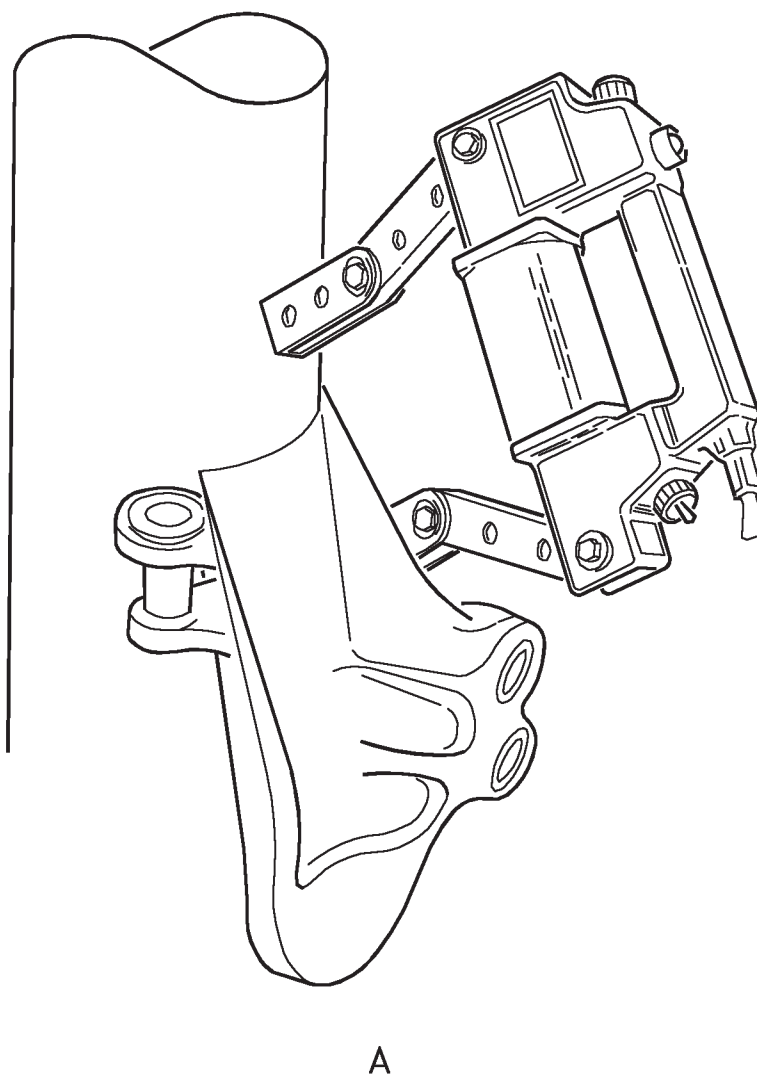
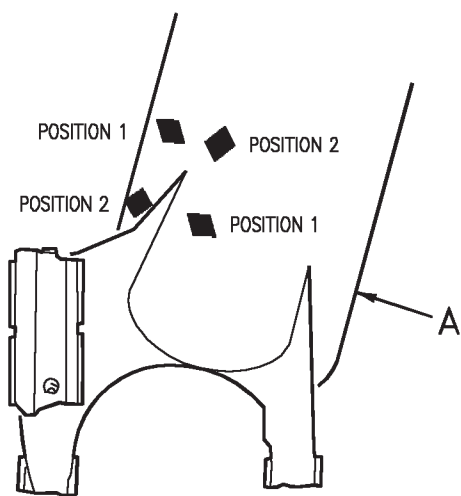
### 12. SYSTEM SECURING.

a. Have electrical wire cable reclamped into position (A1-F18AC-130-300, WP037 00).

b. Have emergency brake line reinstalled (A1-F18AC-130-300, WP037 00).



**Figure 1. Inspection Area and Crack Location**



**Figure 2. Magnetic Particle Inspection Probe Positions**

## INTERMEDIATE MAINTENANCE

## NONDESTRUCTIVE INSPECTION

## MAIN LANDING GEAR TRUNNION LOWER SECTION CRACK VERIFICATION

PART NO. 74A410511

This WP Supersedes WP069 02, dated 15 December 1992

## Reference Material

Naval Aviation Maintenance Program .....	OPNAVINST 4790.2
Plane Captain Manual .....	A1-F18AC-PCM-000
Aircraft Corrosion Control.....	A1-F18AC-SRM-500
Landing Gear, Arresting Hook, And Launch Bar, Finish System And Markings.....	WP042 00
Landing Gear and Related Systems.....	A1-F18AC-130-300
MLG Trunnion Assembly (15MAP585 or 15MAR586).....	WP037 00
Nondestructive Inspection.....	A1-F18AC-SRM-300
Pulse-Echo Shear Wave, Angle Beam, Contact of Metallic Materials .....	WP008 14
Pulse-Echo, Longitudinal Wave Contact, Without Delay Line, of Metallic Materials .....	WP008 05

## Alphabetical Index

Subject	Page No.
Main Landing Gear Trunnion.....	1
Defects .....	1
Post Inspection Cleaning and Corrosion Control.....	5
Primary Inspection Method .....	1
System Securing.....	6
Ultrasonic Method Using C-398 Ultrasonic Flaw Detector .....	2
Ultrasonic Method Using MXU-715/E Ultrasonic Flaw Detector .....	4

## Record of Applicable Technical Directives

None

## 1. MAIN LANDING GEAR TRUNNION.

2. Main landing gear trunnion (trunnion) is machined 300M steel forging. External surface is IVD aluminum coated or cadmium plated. Finish system is epoxy primer and enamel topcoat. Internal surface is coated with epoxy primer and thin layer of sealant.

3. **DEFECTS.** Inspect for cracks on lower section of main landing gear trunnion. Cracks will be found in 3 X 3 inch inspection area shown on figure 1.

4. **PRIMARY INSPECTION METHOD.** Primary inspection method is ultrasonic.

5. **Personnel Qualifications.** Personnel doing this nondestructive inspection should be qualified and certified to do ultrasonic inspections per OPNAVINST 4790.2 SERIES, NDI Technicians, NEC 7225/MOS 6044.

6. **Preparation of Aircraft.** No special preparation required.

7. **Access.** No special access required.

#### 8. ULTRASONIC METHOD USING C-398 FLAW DETECTOR.

### Support Equipment Required

#### NOTE

Alternate item type designations or part numbers are listed in parentheses.

Part Number or Type Designation	Nomenclature
C-398	Ultrasonic Flaw Detector
57A2271 or EQUIVALENT	Microdot to BNC Connecting Cable
57A2252 or EQUIVALENT	45°, 0.250 X 0.250 Inch, 5 MHz Contact Search Unit
74D110007-1001 (74SB2462)	Ultrasonic Reference Standard for MLG Lever

### Materials Required

#### NOTE

Alternate item specifications or part numbers are shown indented.

Specification or Part Number	Nomenclature
ULTRAGEL II or EQUIVALENT	Couplant
MIL-P-83953-2, TYPE 1, CLASS A or B, RED or BLACK	Aircraft Marking Pencil
P-D-680, TYPE 2 D 1153	Dry Cleaning Solvent Methyl Isobutyl Ketone

### Materials Required (Continued)

Specification or Part Number	Nomenclature
CCC-C-46, TYPE 1, CLASS 4	Cleaning Cloth
—	Clear Tape, Transparent Tape

#### 9. Preparation of Part.

a. Have electrical wire cable unclamped and tied back clear of inspection area (A1-F18AC-130-300, WP037 00).

b. Have emergency brake line, smaller diameter tube, removed (A1-F18AC-130-300, WP037 00).

#### WARNING

Dry cleaning solvent and methyl isobutyl ketone are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

c. Clean inspection area with solvent moistened cloth to make sure inspection area is free of contamination or foreign material.

#### WARNING

Make sure safety precautions have been met for electrical, static, grounding when using ultrasonic equipment near aircraft fuel cells, oxygen systems, electrical systems, and stores (A1-F18AC-PCM-000).

#### 10. Equipment Settings/Standardization/ Setup. See figure 3.

a. Do Equipment Settings/Standardization/Setup (WP008 05), except as below:



**NOTE**

Equipment differences may require use of alternate COARSE SWEEP RANGE, FREQ, REP RATE, FINE SWEEP RANGE, VIDEO DISPLAY, DAMPING, and REJECT settings.

COARSE SWEEP RANGE	2.0 INCHES
ATTENUATORS .....	2, 4, 8, 16 IN, 32 OUT
COARSE SWEEP DELAY .....	0-3 INCHES
MODE .....	PULSE ECHO
FINE GAIN .....	MID SCALE
COARSE GAIN .....	3 (APPROX)
REP RATE.....	AUTO
FINE SWEEP RANGE.....	MID SCALE
DAMPING.....	MID SCALE
VIDEO DISPLAY .....	FULL WAVE

b. Apply couplant to 74D110007-1001 reference standard approximately 0.50 inch from EDM notch.

c. Position front edge of search unit 0.50 inch from EDM notch as shown in figure 2.

d. Maximize EDM response by swiveling search unit and removing excess couplant between search unit and EDM notch.

e. Adjust SWEEP RANGE so EDM notch response is located at 2 on CRT horizontal baseline, see figure 3, CRT 1.

f. Reposition search unit front edge 1.5 inch from EDM notch and maximize response by swiveling search unit and removing excess couplant between search unit and EDM notch.

g. Adjust SWEEP RANGE so 1.5 inch EDM response leading edge is located at 6 on CRT horizontal baseline.

h. Reposition search unit 0.50 inch from notch and if response leading edge is no longer located at 2, adjust SWEEP DELAY to relocate response at 2 on horizontal baseline. Repeat this process until 0.50 inch EDM notch response is located at 2 on horizontal baseline and 1.5 inch EDM notch response is located at 6 on CRT horizontal baseline.

**NOTE**

Initial pulse location may be moved off screen during this standardization.

Gain may be adjusted by changing FINE GAIN, COARSE GAIN, or by toggling ATTENUATORS.

i. Position search unit 0.50 inch from EDM notch.

j. Adjust GAIN to bring EDM notch response amplitude to 70-75 percent CRT height.

k. Place transparent tape over filter covering CRT screen.

l. Develop distance-amplitude correction (DAC) curve by marking response peak on tape covering CRT filter using aircraft marking pencil.

m. Position search unit 1 inch and 1.5 inches from EDM notch and mark response peak on tape covering CRT at each location. See figure 3, CRT 2.

n. For 74SB2462 reference standard add maximum of 6 dB GAIN and verify EDM notch response amplitude increases. For 74D110007-1001 reference standard, add 14dB GAIN and verify EDM notch response amplitude increases.

**11. Inspection Procedures.**

a. Apply couplant to inspection area.

**NOTE**

Only light film of couplant is required. Excess couplant may cause false indications.

b. Position search unit on inspection area approximately 1.5 inches from magnetic particle crack indication.

c. Scan toward crack indication. Make sure sound beam is perpendicular to length of crack, see figure 4.

d. Mark any response more than DAC curve using aircraft marking pencil, see figure 5, CRT 1.

e. Verify crack by damping crack response.

- f. Do paragraphs 16 and 17.

## 12. ULTRASONIC METHOD USING MXU-715/E ULTRASONIC FLAW DETECTOR.

### Support Equipment Required

Part Number or Type Designation	Nomenclature
1642AS100-1	Ultrasonic Flaw Detector, MXU-715/E, Magnaflux
57A2271 or EQUIVALENT	Microdot to BNC Connecting Cable
57A2252 or EQUIVALENT	45°, 0.250 X 0.250 Inch, 5 MHz Con- tact Search Unit
74D110007-1001 (74SB2462)	Ultrasonic Reference Standard for MLG Lever

### Materials Required

#### NOTE

Alternate item specifications or part numbers are shown indented.

Specification or Part Number	Nomenclature
ULTRAGEL II or EQUIVALENT	Couplant
MIL-P-83953-2,TYPE 1, CLASS A or B, RED or BLACK	Aircraft Marking Pencil
P-D-680, TYPE 2 D 1153	Dry Cleaning Solvent Methyl Isobutyl Ketone
CCC-C-46, TYPE 1, CLASS 4	Cleaning Cloth
—	Clear Tape, Transparent Tape

## 13. Preparation of Part.

- a. Have electrical wire cable unclamped and tied back clear of inspection area (A1-F18AC-130-300, WP037 00).

- b. Have emergency brake line, smaller diameter tube, removed (A1-F18AC-130-300, WP037 00).

#### WARNING

Dry cleaning solvent and methyl isobutyl ketone are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

- c. Clean inspection area(s) with water moistened cloth, or solvent, as required, to make sure inspection area(s) is free of contamination or foreign material.

#### WARNING

Make sure safety precautions have been met for electrical, static, grounding when using ultrasonic equipment near aircraft fuel cells, oxygen systems, electrical systems, and stores (A1-F18AC-PCM-000).

## 14. Equipment Settings/Standardization/Setup.

- a. Do Equipment Settings/Standardization/Setup (WP008 14), except as below:

GAIN (dB) .....	64
COURSE GAIN .....	6
FINE GAIN .....	4
HORIZONTAL	
SWEEP LENGTH	
COURSE .....	5
FINE .....	9.5

#### NOTE

Tester settings listed here are given as initial setup guide. Equipment differences may require us of alternate REP. RATE, DAMP., FREQ., GAIN, REJECT, and HORIZONTAL SWEEP DELAY and LENGTH.

- b. Apply couplant to 74D110007-1001 reference standard approximately 0.50 inch from EDM notch.

c. Position front edge of search unit 0.50 inch from EDM notch as shown in figure 2.

d. Maximize EDM response by swiveling search unit and removing excess couplant between search unit and EDM notch.

e. Adjust HORIZONTAL SWEEP LENGTH so EDM notch response is located at 2 on CRT horizontal baseline, see figure 3, CRT 1.

f. Reposition search unit front edge 1.5 inch from EDM notch and maximize response by swiveling search unit and removing excess couplant between search unit and EDM notch.

g. Adjust HORIZONTAL SWEEP LENGTH so 1.5 inch EDM response leading edge is located at 6 on CRT horizontal baseline.

h. Reposition search unit 0.50 inch from notch and if response leading edge is no longer located at 2, adjust HORIZONTAL SWEEP DELAY to relocate response at 2 on horizontal baseline. Repeat this process until 0.50 inch EDM notch response is located at 2 on horizontal baseline and 1.5 inch EDM notch response is located at 6 on CRT horizontal baseline.

### NOTE

Initial pulse location may be moved off screen during this standardization.

i. Position search unit 0.50 inch from EDM notch.

j. Adjust GAIN to bring EDM notch response amplitude to 70-75 percent CRT height. Place transparent tape over filter covering CRT screen.

k. Develop distance-amplitude correction (DAC) curve by marking response peak on tape covering CRT filter using aircraft marking pencil.

l. Position search unit 1 inch and 1.5 inches from EDM notch and mark response peak on tape covering CRT at each location. See figure 3, CRT 2.

### NOTE

Gain may be adjusted by changing FINE GAIN, COARSE GAIN, or by toggling ATTENUATORS.

m. For 74SB2462 reference standard add maximum of 6 dB GAIN and verify EDM notch response amplitude increases. For 74D110007-1001 reference standard, add 14dB GAIN and verify EDM notch response amplitude increases.

### 15. Inspection Procedures.

a. Apply couplant to inspection area.

### NOTE

Only light film of couplant is required. Excess couplant may cause false indications.

b. Position search unit on inspection area approximately 1.5 inches from magnetic particle crack indication.

c. Scan toward crack indication. Make sure sound beam is perpendicular to length of crack, see figure 4.

d. Mark any response more than DAC curve using aircraft marking pencil, see figure 5, CRT 1.

e. Verify crack by damping crack response.

### 16. POST INSPECTION CLEANING AND CORROSION CONTROL.

### WARNING

Dry cleaning solvent and methyl isobutyl ketone are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

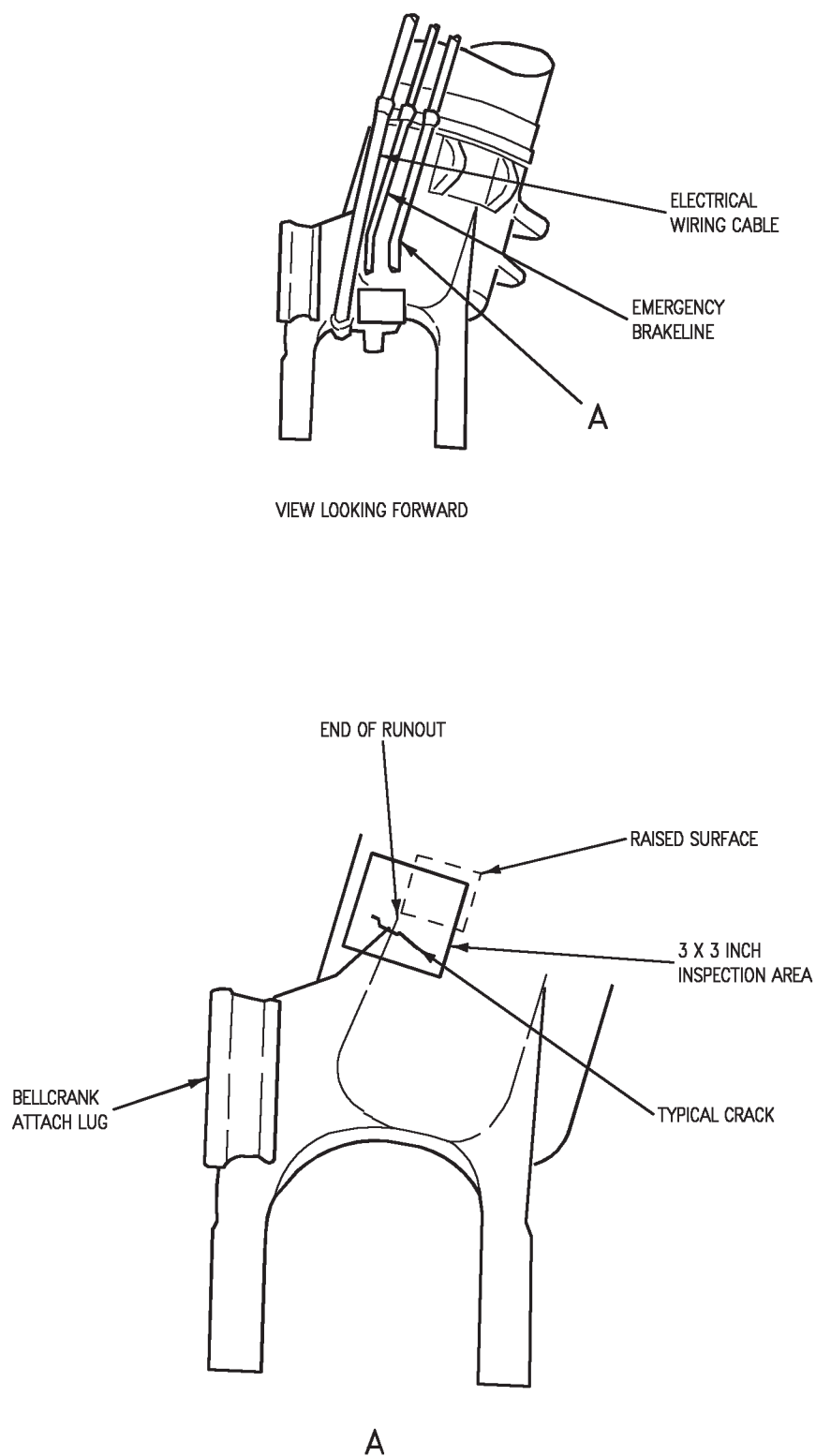
a. If no crack indication(s) is found, clean inspection area with solvent moistened cloth.

b. Refinish inspection area (A1-F18AC-SRM-500, WP042 00).

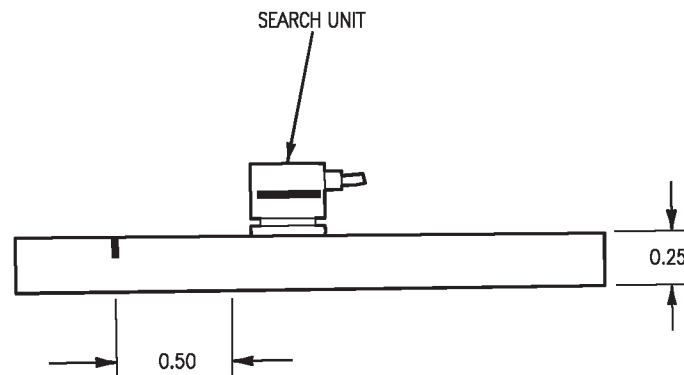
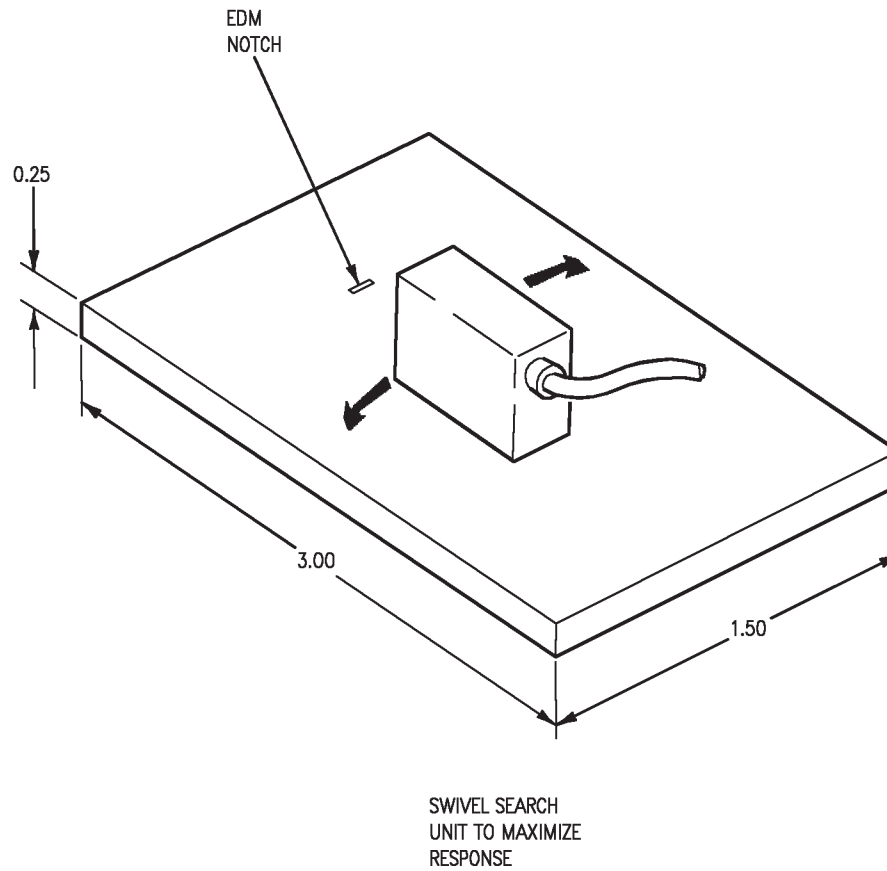
17. **SYSTEM SECURING.**

a. Have electrical wire cable reclamped into position (A1-F18AC-130-300, WP037 00).

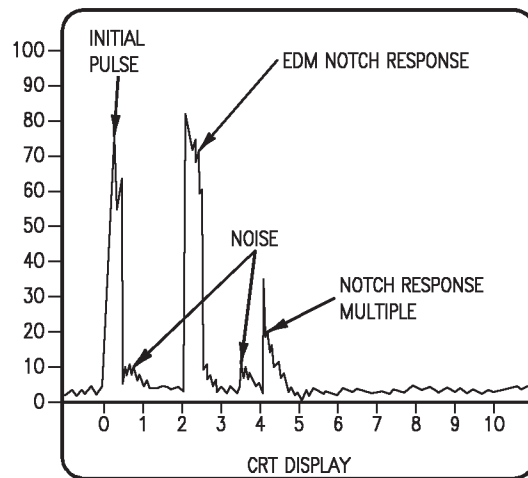
b. Have emergency brake line reinstalled (A1-F18AC-130-300, WP037 00).



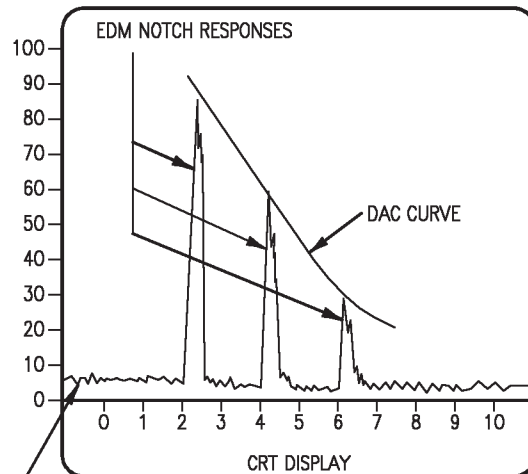
**Figure 1. Inspection Area and Crack Location**



**Figure 2. Ultrasonic Reference Standard**



CRT 1

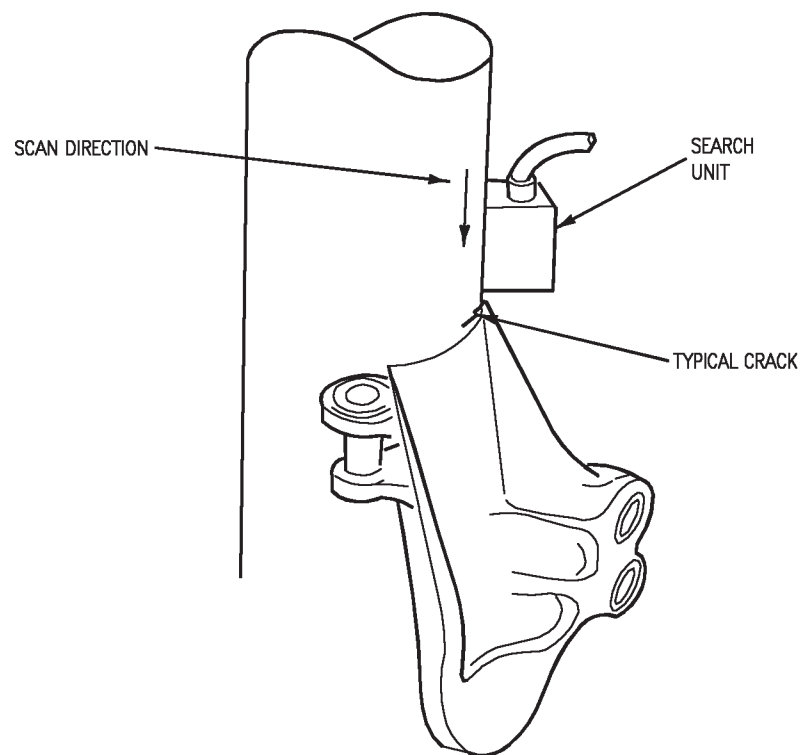


INITIAL PULSE  
OFF-SCREEN, NOT  
VISIBLE HERE.

INITIAL PULSE MAY MOVE  
OFF-SCREEN DURING THIS  
STANDARDIZATION. RESPONSE  
MULTIPLES FROM EDM NOTCH  
MAY BE VISIBLE ON CRT.

CRT 2

Figure 3. Standardization



**Figure 4. Scan Direction**



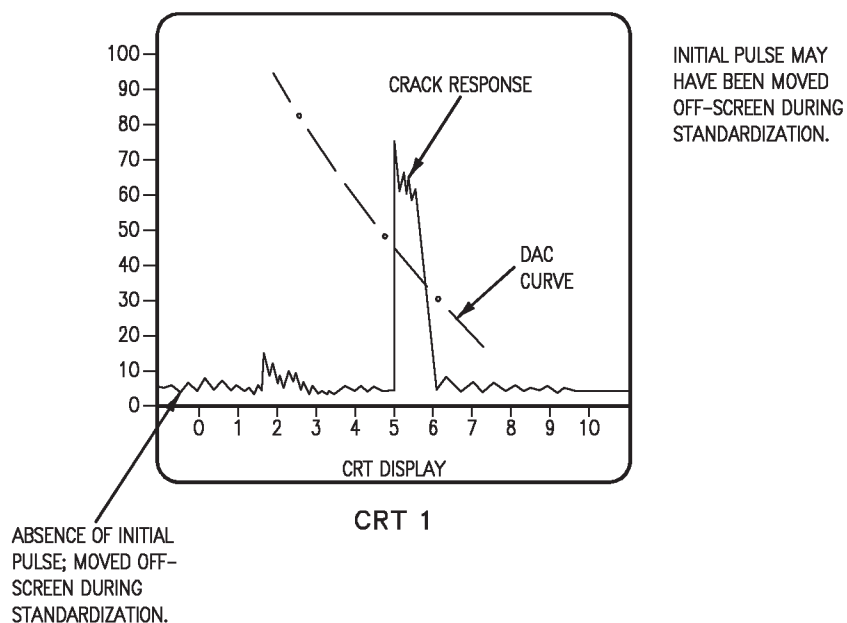


Figure 5. Rejectable Crack Response



## INTERMEDIATE AND DEPOT MAINTENANCE

## NONDESTRUCTIVE INSPECTION

## MAIN LANDING GEAR AXLE LEVER ASSEMBLY CRACKS

PART NO. 74A410506

PART NO. 74A410566

This WP supersedes WP069 03, dated 15 December 1992.

## Reference Material

Naval Aviation Maintenance Program .....	OPNAVINST 4790.2
Landing Gear and Related Systems.....	A1-F18AC-130-300
MLG Axle Lever Assembly (12MAP577) or (12MAR578) and MLG Lever	
Swing Joint Support .....	WP040 00
Aircraft Weapons Systems Cleaning and Corrosion Control.....	NAVAIR 01-1A-509
Nondestructive Inspection.....	A1-F18AC-SRM-300
Magnetic Particle Method.....	WP006 00
Residual Stress Measurements for Main Landing Gear Levers .....	WP069 05
Main Landing Gear Axle Lever Assembly Crack Verification.....	WP069 04

## Alphabetical Index

Subject	Page No.
Main Landing Gear Axle Lever Assembly .....	1
Defects .....	1
Primary Inspection Method .....	1

## Record of Applicable Technical Directives

Type/ Number	Date	Title and ECP No.	Date Incorp.	Remarks
F/A-18 AFB 113 REV A AMEND 2	22 Apr 87	Inspection of Main Landing Gear (MLG) Axle Lever Assembly	1 Nov 87	-

## 1. MAIN LANDING GEAR AXLE LEVER ASSEMBLY.

2. Main landing gear axle lever assembly (lever assembly) is machined 300 M steel forging. External surface is IVD aluminum coated or cadmium plated. Finish system is epoxy primer and enamel topcoat. Internal surface is cadmium plated and coated with epoxy primer.

3. **DEFECTS.** Inspect lever assembly for cracks in inspection areas A and B as shown on figure 1.

4. **PRIMARY INSPECTION METHOD.** Primary inspection method is magnetic particle.

5. **Personnel Qualifications.** Personnel doing this nondestructive inspection should be qualified and certified to do magnetic particle inspections per

OPNAVINST 4790.2 SERIES, NDI Technicians, NEC 7225/MOS 6044.

6. **Preparation of Aircraft.** No special preparation required.

7. **Access.** No special access required.

### Support Equipment Required

#### NOTE

Alternate item type designations or part numbers are listed in parentheses.

Part Number or Type Designation	Nomenclature
DA200	Magnetic Inspection Probe
2480	Magnetic Particle Field Indicator
ZB-26 (M-16) J-60 (92957)	Black Light, Portable Parker Magnetic Probe Adapter ( Probe Adapter)
J-221	Ultraviolet Meter

### Materials Required

Specification or Part Number	Nomenclature
MIL-R- 81294	Paint Remover
MILT81772TY1	Thinner, Paint
MILC87962TYPE1	Cloth, Cleaning
MIL-C-85570	Cleaning Compound
MILT22085TY1	Tape, Pressure Sensitive
MILB121TY1GRACL1	Barrier Material
M83953-1 or -2	Pencil, Aircraft Marking
MILC85054TYPE1	Corrosion Preventive Compound
HB695TYPE1 GRADEASIZE1	Varnish Brush

8. **Preparation of Part.** See figure 2.

a. Have both brake hydraulic tube assemblies removed, if probe adapter (s) is not being used for

inspection (A1-F18AC-130-300, WP040 00). If probe adapter(s) is being used, go to step b.

b. Have electrical cable assemblies unclamped and tied back, as required (A1-F18AC-130-300, WP040 00).

c. Using pressure sensitive tape and barrier material, mask area surrounding inspection areas.

#### WARNING

Paint remover is toxic. Avoid breathing of vapors. Avoid contact with skin or eyes. Wear gloves and goggles while handling. If eye contact is made, wash immediately with large amount of water. If skin contact is made, wash immediately with soap and water.

#### CAUTION

Make sure paint remover does not contact surrounding areas of lever assembly. Damage to finish system may result.

Do not use abrasive means to remove finish system. Invalid residual stress measurements will result.

d. Have finish system removed from inspection areas (NAVAIR 01-1A-509, Section 5) Corrective Maintenance.

(1) Make sure paint is also removed from uplock lug aft radii and shock absorber attach lug forward radii.

#### WARNING

Paint thinner is highly flammable and toxic. Do not use near open flame or sparks. Use only in well ventilated areas.

(2) If corrosion preventive compound has been applied to inspection area, remove with cleaning cloth moistened with paint thinner.

e. Clean inspection area with water and alkaline solution, one part aircraft cleaning compound to

nine parts water. This is to neutralize any residual paint remover.

#### 9. Equipment Settings/Standardization/Setup.

For True Continuous Longitudinal Magnetization Using Probe and below.

#### NOTE

Direct current (DC) is recommended for all magnetic particle inspections especially when detection of flaws not open to surface is required.

a. Set AC/DC switch to DC.

b. Adjust magnetization intensity control to MAXIMUM.

c. Probe operation and sensitivity. Do Equipment Settings/Standardization/ Setup for Longitudinal Magnetization Using Probe and figure 1 (WP006 00).

#### 10. Inspection Procedure.

a. With brake hydraulic tube assemblies removed:

(1) Make darkened area for inspection.

(2) Position probe on position one, see figure 3.

(3) Make sure of maximum surface area contact of probe legs with axle lever to provide maximum magnetization.



Duty cycle for probe is 2 minutes on, 2 minutes off. Coil cover heating is indication of excess on time.

#### NOTE

Do not deenergize probe until inspection is completed.

(4) Press ON to magnetize axle lever and immediately apply fluorescent magnetic inspection compound to inspection area. Magnetization should be on for at least 1 minute after application of fluorescent inspection material. Crack indications usually are found in circumferential direction.

(5) Inspect complete inspection areas for cracks, use black light.

(6) Mark location of defect indications with an aircraft marking pencil and record.

(7) Repeat substeps (2) through (6) for probe positions 2 and 3.

(8) Demagnetize (WP006 00).

b. With brake hydraulic tube assemblies in place, refer to paragraph 8: Area A, probe positions 1 and 2 are inspected with magnetic probe adapters attached to probe. Use NARF NORIS photographs to show position of probe for each probe position.

photograph	contour probe position
15589 and 15590	1
15588 and 15591	2
15592	3



Do not push on hydraulic tubes with more than light pressure, one finger, to increase clearance. Titanium tubes are easily damaged.

(1) Attach probe adapter to one leg of probe. Make sure full contact between adapter and probe leg is made. Two adapters may be used to make sure maximum contact of adapter and lever assembly is made. Hydraulic tube assemblies may be deflected using pressure from one finger to allow correct clearance and contact for inspection.

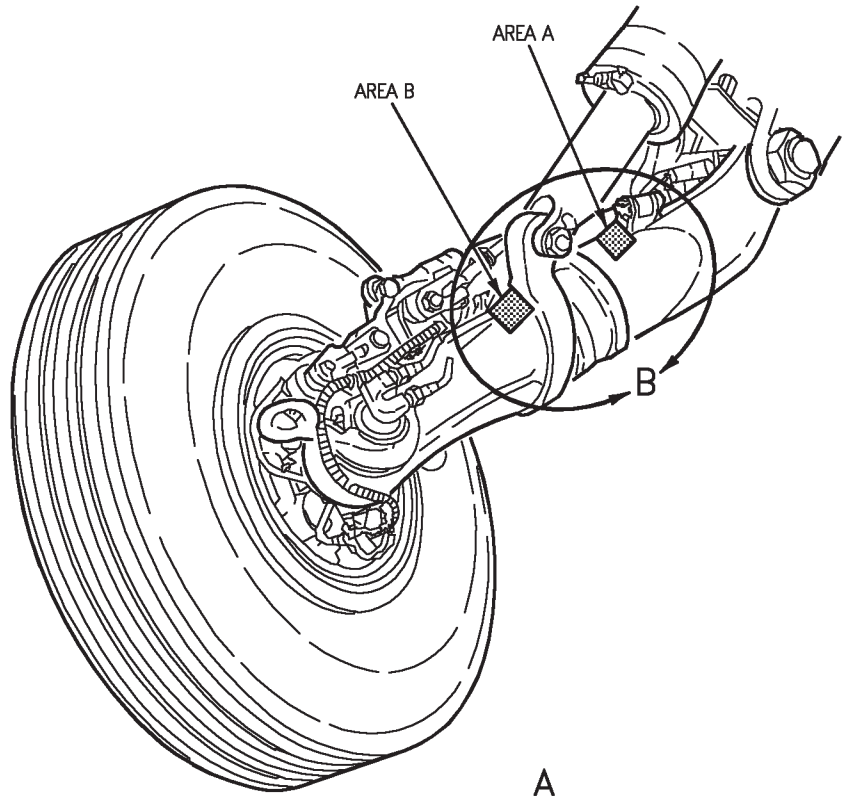
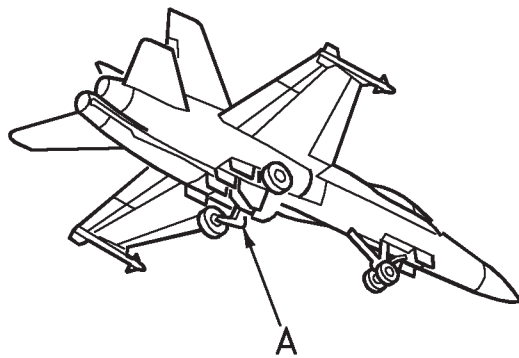
(2) Do substeps (2) through (6) for positions 1 and 2 using probe adapters.

(3) Repeat substeps (2) through (6) for position 3 without probe adapters.

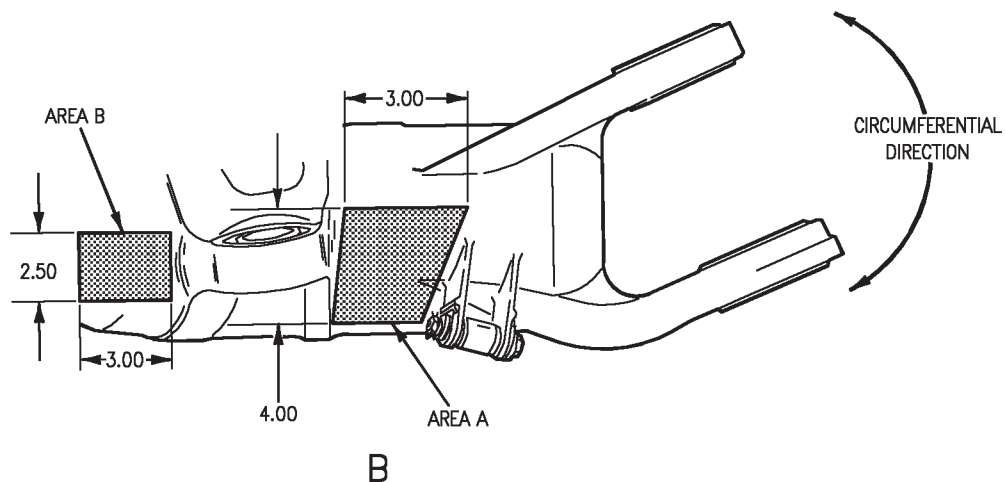
(4) Demagnetize (WP006 00).

c. If no crack indication(s) is found, do (WP069 05).

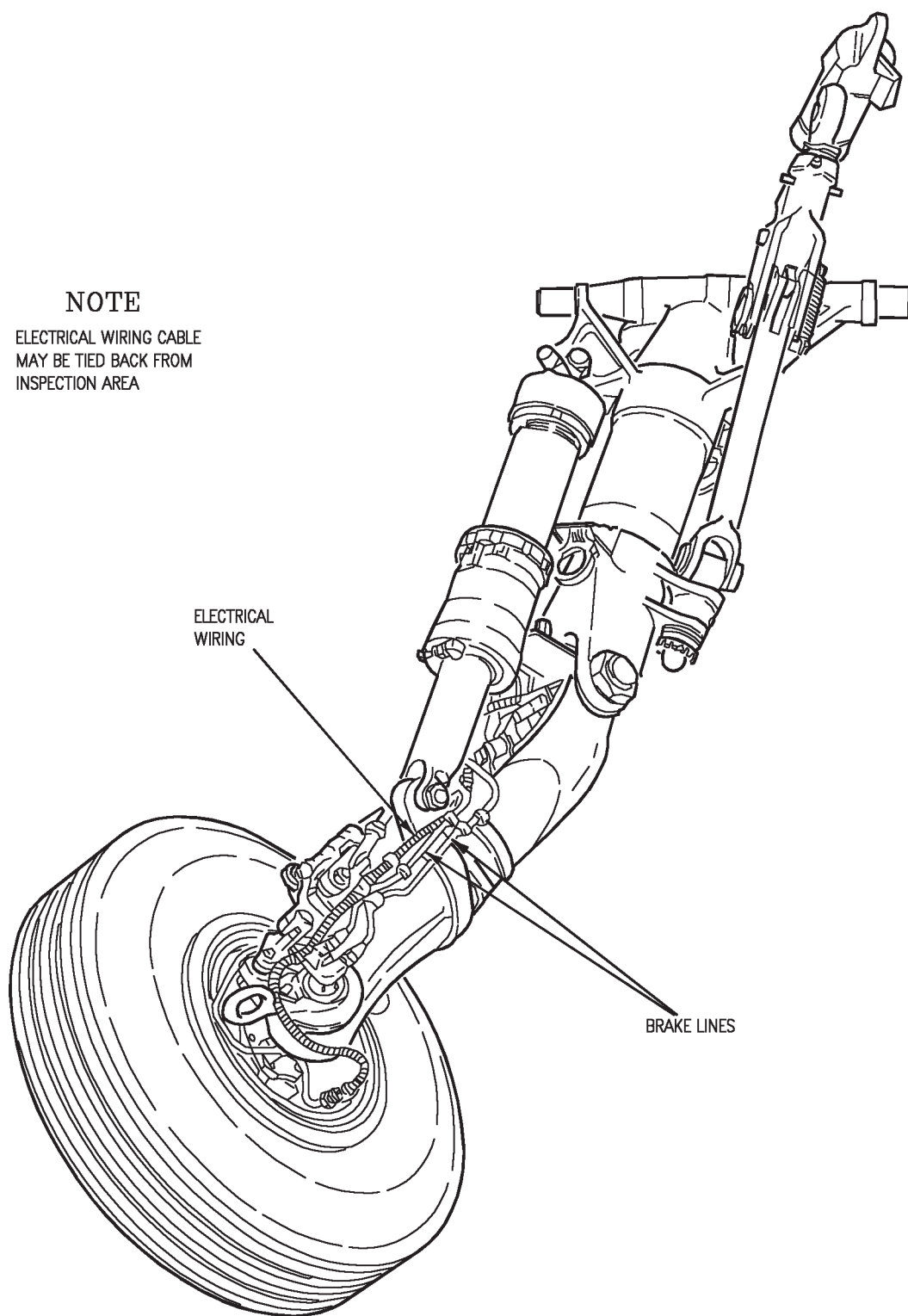
d. If crack indication(s) is found, do (WP069 04).



## LEGEND



**Figure 1. Main Landing Gear Lever Assembly Inspection Areas**



**Figure 2. Components Removed For Inspection**

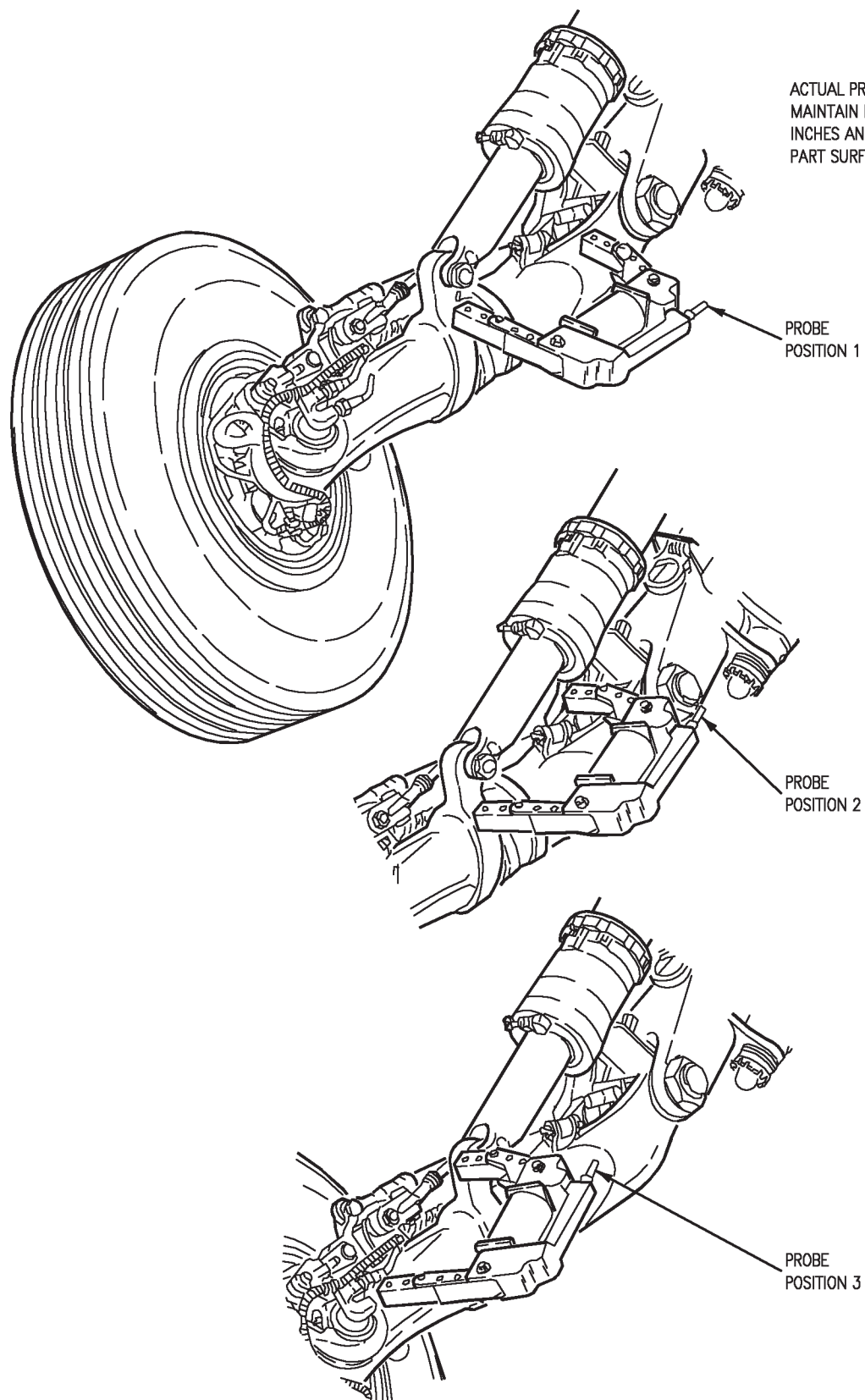


Figure 3. Magnetic Particle Inspection



## INTERMEDIATE MAINTENANCE

## NONDESTRUCTIVE INSPECTION

## MAIN LANDING GEAR AXLE LEVER ASSEMBLY CRACK VERIFICATION

PART NO. 74A410561

PART NO. 74A410566

## Reference Material

Naval Aviation Maintenance Program .....	OPNAVINST 4790.2
Plane Captain Manual .....	A1-F18AC-PCM-000
Landing Gear and Related Systems.....	A1-F18AC-130-300
MLG Axle Lever Assembly (12MAP577) or (12MAR578) and MLG Lever Swing Joint Support .....	WP040 00
Nondestructive Inspection.....	A1-F18AC-SRM-300
Ultrasonic Pulse-Echo Surface Wave Inspection of Metallic Materials .....	WP008 07
Residual Stress Measurement for Main Landing Gear Levers .....	WP069 05
Special/Preservation Maintenance Requirements Cards (F/A-18A and F/A-18B) .....	A1-F18AC-MRC-250
Special/Preservation Maintenance Requirements Cards (F/A-18C and F/A-18D) .....	A1-F18AE-MRC-250

## Alphabetical Index

Subject	Page No.
Main Landing Gear Axle Level Assembly.....	1
Defects .....	1
Primary Inspection Method .....	2
Ultrasonic Method Using C-398 Ultrasonic Flaw Detector .....	2
Ultrasonic Method Using MXU-715/E Ultrasonic Flaw Detector .....	4

## Record of Applicable Technical Directives

Type/ Number	Date	Title and ECP No.	Date Incorp.	Remarks
F/A-18 AFB 113 REV A AMEND 2	22 Apr 87	Inspection of Main Landing Gear (MLG) Axle Lever Assembly	1 Nov. 87	—

## 1. MAIN LANDING GEAR AXLE LEVER ASSEMBLY.

2. Main landing gear axle lever assembly (lever assembly) is machined 300M steel forging. External surface is IVD, aluminum, coated or cadmium

plated. Finish system is epoxy primer and enamel topcoat. Internal surface is cadmium plated and coated with epoxy primer.

3. **DEFECTS.** Inspect lever assembly for cracks in inspection areas A and B as shown in figure 1.

4. **PRIMARY INSPECTION METHOD.** Primary inspection method is ultrasonic.

5. **Personnel Qualifications.** Personnel doing this nondestructive inspection should be qualified and certified to do ultrasonic inspections per OPNAVINST 4790.2 SERIES, NDI Technicians, NEC 7225/MOS 6044

6. **Preparation of Aircraft.** No special preparation required.

7. **Access.** No special access required.

#### 8. ULTRASONIC METHOD USING C-398 ULTRASONIC FLAW DETECTOR.

### Support Equipment Required

#### NOTE

Alternate item type designations or part numbers are listed in parentheses.

Part Number or Type Designation	Nomenclature
C-398	Ultrasonic Flaw Detector
57A2271 or EQUIVALENT	Microdot to BNC Connecting Cable
57A3055 or EQUIVALENT	90°, 0.250 Inch X 0.250 inch, 5 MHz, Con- tact Surface Wave Search Unit
74D110007-1001 (74SB2462)	Ultrasonic Reference Standard for MLG Lever, Stamped add 14 dB

### Materials Required

Specification or Part Number	Nomenclature
ULTRAGEL II M83953-1 or -2	Ultrasonic Couplant Pencil, Aircraft Marking
020X413	Cleaning Compound
—	Clear Tape, Trans- parent Tape, Scotch tape or Equivalent

### Materials Required (Continued)

Specification or Part Number	Nomenclature
CCCC46TY1CL4	Cloth, Cleaning
HB695TYPE1	Varnish Brush
GRADEASIZE1	
1/2 INCH	

#### 9. Preparation of Part.

#### WARNING

Cleaning compound is a flammable liquid and vapor. May cause allergic respiratory and skin reaction. May cause eye, skin and respiratory irritation. Keep away from heat, sparks, and flame. Do not breathe dust (vapor, mist, gas). Use only with enough ventilation. Keep container closed. Avoid contact with eyes, skin and clothing. Wash thoroughly after handling.

a. Clean inspection area with cleaning cloth moistened with cleaning compound. This ensures that the inspection area is free of contamination or foreign material. Allow to air dry for 15 minutes.

b. See figure 2. Have brake hydraulic tube assemblies removed if interference with inspection area is obvious (A1-F18AC-130-300, WP040 00).

c. Have electrical cable assemblies unclamped and tied back, as required (A1-F18AC-130-300, WP040 00).

#### WARNING

Make sure safety precautions have been met for electrical, static, grounding when using ultrasonic equipment near aircraft fuel cells, oxygen systems, electrical systems, and stores (A1-F18AC-PCM-000).

#### 10. Equipment Settings/Standardization/Setup.

a. Do general setup per (WP008 07). Start with initial equipment settings listed in (WP008 07) except as follows:

# A1-F18AC-SRM-310

Change 9

069 04

Page 2A/(2B blank)

## NOTE

Equipment differences may require use of alternate COARSE SWEEP RANGE, FREQ, REP RATE, FINE SWEEP RANGE, VIDEO DISPLAY, DAMPING, and REJECT settings.

### COARSE SWEEP

RANGE ..... 2.0 INCHES

ATTENUATORS ..... 2, 4, 8, 16 IN, 32 OUT

### COARSE SWEEP

DELAY ..... 0-3 INCHES

FINE GAIN ..... MID SCALE

COARSE GAIN ..... 3 (APPROX)

### FINE SWEEP

RANGE ..... MID SCALE

DAMPING ..... MID SCALE

REJECT ..... ZERO



b. Apply couplant to 74D110007-1001 reference standard approximately 0.50 inch from EDM notch.

c. Position front edge of search unit 0.50 inch from EDM notch as shown in figure 3.

d. Maximize EDM response by swiveling search unit and removing excess couplant between search unit and EDM notch.

e. Adjust SWEEP RANGE so EDM notch response is located at 2 on CRT horizontal baseline. See figure 4, CRT 1.

f. Reposition search unit front edge 1.5 inch from EDM notch and maximize response by swiveling search unit and removing excess couplant between search unit and EDM notch.

g. Adjust SWEEP RANGE so 1.5 inch EDM response leading edge is located at 6 on CRT horizontal baseline.

h. Reposition search unit 0.50 inch from notch. If response leading edge is no longer located at 2 on horizontal baseline, adjust SWEEP DELAY to relocate response at 2 on horizontal baseline. Repeat process until 0.50 inch EDM notch response is located at 2 and 1.5 inch EDM notch response is located at 6 on CRT horizontal baseline.

### NOTE

Initial pulse location may be moved off screen during this standardization.

i. Position search unit 0.50 inch from EDM notch.

### NOTE

GAIN may be adjusted by changing FINE GAIN, COARSE GAIN, or by toggling ATTENUATORS.

j. Adjust GAIN to bring EDM notch response amplitude to 70-75 percent CRT height.

k. Place transparent tape over filter covering CRT screen.

l. Develop distance-amplitude correction (DAC) curve by marking response peak on tape covering CRT filtering using aircraft marking pencil.

m. Position search unit 1 inch and 1.5 inches from EDM notch.

n. Mark response peak on tape covering CRT at each location. See figure 4, CRT 2.

o. For 74D110007-1001 reference standard add 14dB GAIN and verify EDM notch response amplitude increases. For 74SB2462 reference standard add no GAIN.

### 11. Inspection Procedure.

a. Apply couplant to inspection area.

### NOTE

Only light film of couplant is required. Excess couplant may cause false indications.

b. Position search unit on inspection area.

c. Scan, in longitudinal direction, toward crack indication. Make sure sound beam is perpendicular to length of crack. See figure 5.

d. Mark any response exceeding DAC curve using aircraft marking pencil. See figure 5, and figure 6.

e. Verify crack by damping crack response.

f. If crack indication is verified, remove and replace lever per (A1-F18AC-130-300, WP040 00).

g. Inspect the MLG axle IAW (A1-F18AC-MRC-250 or A1-F18AE-MRC-250) if the L/R MLG lever assembly fails the NDI inspection and requires removal and replacement.

h. If no crack indication is found do (WP069 05).

12. ULTRASONIC METHOD USING MXU-715/E  
ULTRASONIC FLAW DETECTOR.**Support Equipment Required**

Part Number or Type Designation	Nomenclature
1642AS100-1	Ultrasonic Flaw Detector, MXU-715/E, Magnaflux
57A2271 or EQUIVALENT 57A3055 or EQUIVALENT	Microdot to BNC Connecting Cable 90°, 0.250 Inch X 0.250 inch, 5 MHz, Con- tact Surface Wave Search Unit
74D110007-1001 (74SB2462)	Ultrasonic Reference Standard for MLG Lever, Stamped add 14 dB

**Materials Required**

Specification or Part Number	Nomenclature
ULTRAGEL II M83953-1 or -2	Ultrasonic Couplant Pencil, Aircraft Marking
020X413 —	Cleaning Compound Clear Tape, Trans- parent Tape, Scotch tape or Equivalent
CCCC46TY1CL4I, HB695TYPE1 GRADEASIZE1 1/2 INCH	Cloth, Cleaning Varnish Brush

## 13. PREPARATION OF PART.

**WARNING**

Cleaning compound is a flammable liquid and vapor. May cause allergic respiratory and skin reaction. May cause eye, skin and respiratory irritation. Keep away from heat, sparks, and flame. Do not breathe dust (vapor, mist, gas). Use only with adequate ventilation. Keep container closed. Avoid contact with eyes, skin and clothing. Wash thoroughly after handling.

a. Clean inspection area with cleaning cloth moistened with cleaning compound. This ensures that the inspection area is free of contamination or foreign material. Allow to air dry for 15 minutes.

b. See figure 2. Have brake hydraulic tube assemblies removed if interference with inspection area is evident (A1-F18AC-130-300, WP040 00).

c. Have electrical cable assemblies unclamped and tied back, as required (A1-F18AC-130-300, WP040 00).

**WARNING**

Make sure safety precautions have been met for electrical, static, grounding when using ultrasonic equipment near aircraft fuel cells, oxygen systems, electrical systems, and stores (A1-F18AC-PCM-000).

## 14. Equipment Settings/Standardization/Setup.

a. Do general setup per (WP008 07). Begin with initial equipment settings listed in (WP008 07) except as follows:

GAIN .....	75 dB
COURSE GAIN .....	7
FINE GAIN .....	5
HORIZONTAL	
SWEEP LENGTH	
COURSE .....	5
FINE .....	8.2
HORIZONTAL	
SWEEP DELAY	
COURSE .....	5
FINE .....	7.0

## NOTE

Equipment differences may require use of alternate REP. RATE, DAMP., FREQ., GAIN, and HORIZONTAL SWEEP DELAY and LENGTH.

b. Apply couplant to 74D110007-1001 reference standard approximately 0.50 inch from EDM notch.

c. Position front edge of search unit 0.50 inch from EDM notch as shown in figure 3.

d. Maximize EDM response by swiveling search unit and removing excess couplant between search unit and EDM notch.

e. Adjust HORIZONTAL SWEEP LENGTH so EDM notch response is located at 2 on CRT horizontal baseline. See figure 7, CRT 1.

f. Reposition search unit front edge 1.5 inch from EDM notch and maximize response by swiveling search unit and removing excess couplant between search unit and EDM notch.

g. Adjust HORIZONTAL SWEEP LENGTH so 1.5 inch EDM response leading edge is located at 6 on CRT horizontal baseline.

h. Reposition search unit 0.50 inch from notch. If response leading edge is no longer located at 2 on horizontal baseline, adjust HORIZONTAL SWEEP DELAY to relocate response at 2 on horizontal baseline. Repeat process until 0.50 inch EDM notch response is located at 2 and 1.5 inch EDM notch response is located at 6 on CRT horizontal baseline.

## NOTE

Initial pulse location may be moved off screen during this standardization.

i. Position search unit 0.50 inch from EDM notch and adjust GAIN to get EDM notch response amplitude to 70-75 percent CRT height.

j. Put transparent tape over filter covering CRT screen.

k. Develop distance-amplitude correction (DAC) curve by marking response peak on tape covering CRT filtering using aircraft marking pencil.

l. Position search unit 1 inch and 1.5 inches from EDM notch and mark response peak on tape covering CRT at each location. See figure 7, CRT 2.

m. For 74D110007-1001 reference standard add 14dB GAIN and verify EDM notch response amplitude increases. For 74SB2462 reference standard add no GAIN.

## 15. Inspection Procedure.

a. Apply couplant to inspection area.

## NOTE

Only light film of couplant is required. Excess couplant may cause false indications.

b. Position search unit on inspection area.

c. Scan, in longitudinal direction, toward crack indication. Make sure sound beam is perpendicular to length of crack. See figure 5.

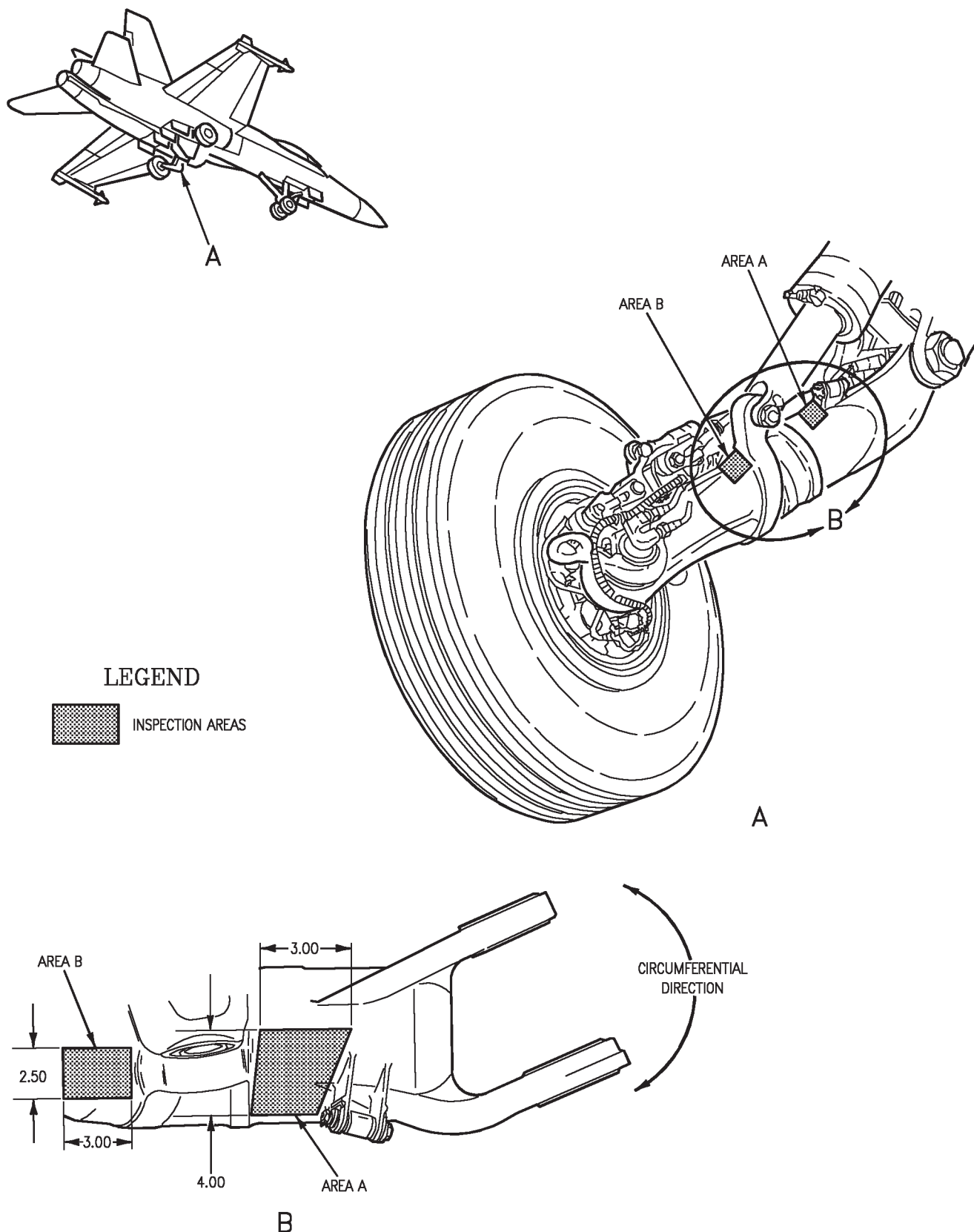
d. Mark any response exceeding DAC curve using aircraft marking pencil. See figure 5, and figure 8, CRT 1.

e. Verify crack by damping crack response.

f. If crack indication is verified, remove and replace lever per (A1-F18AC-130-300, WP040 00).

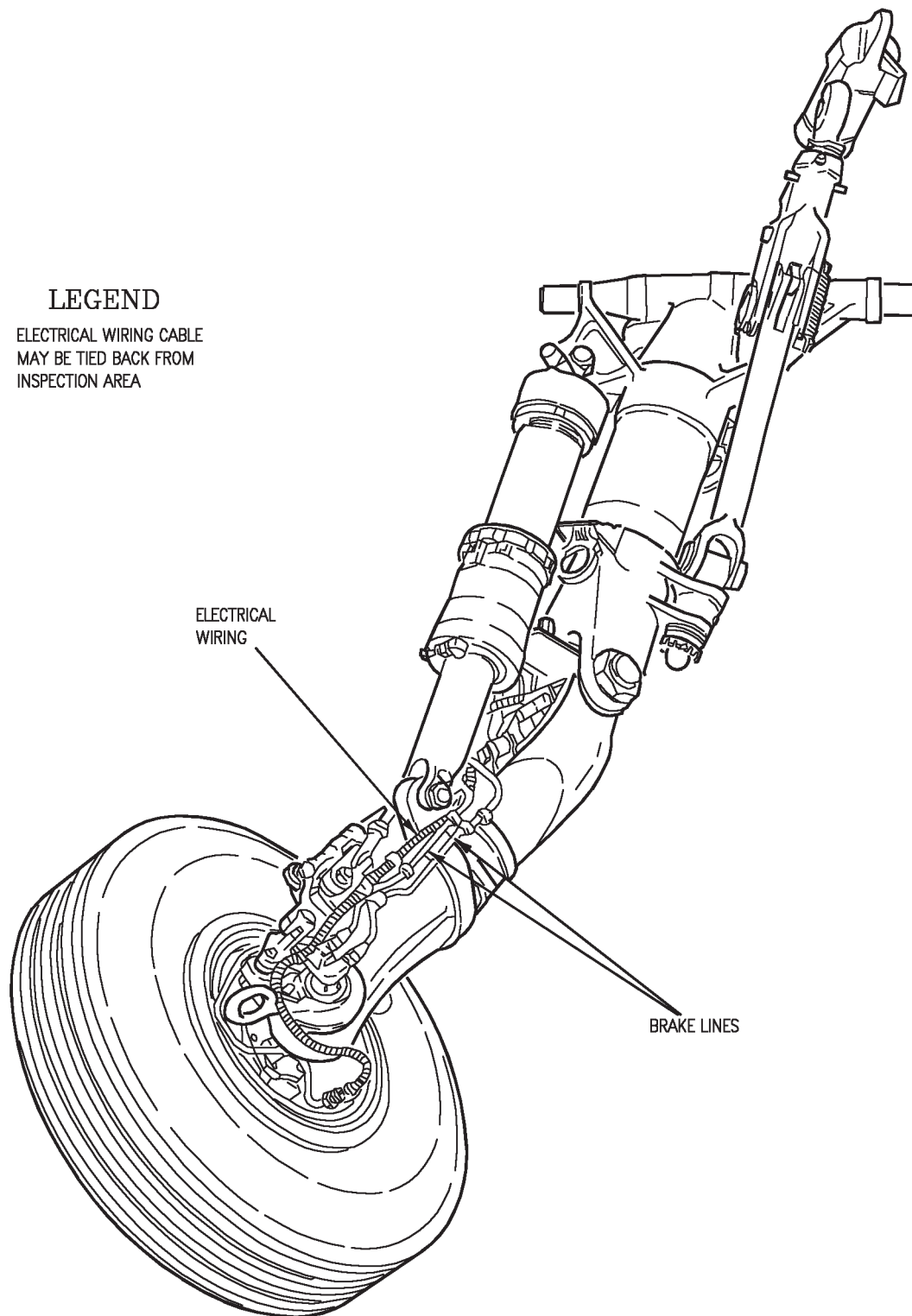
g. Inspect the MLG axle IAW (A1-F18AC-MRC-250 or A1-F18AE-MRC-250) if the L/R MLG lever assembly fails the NDI inspection and requires removal and replacement.

h. If no crack indication is found do (WP069 05).

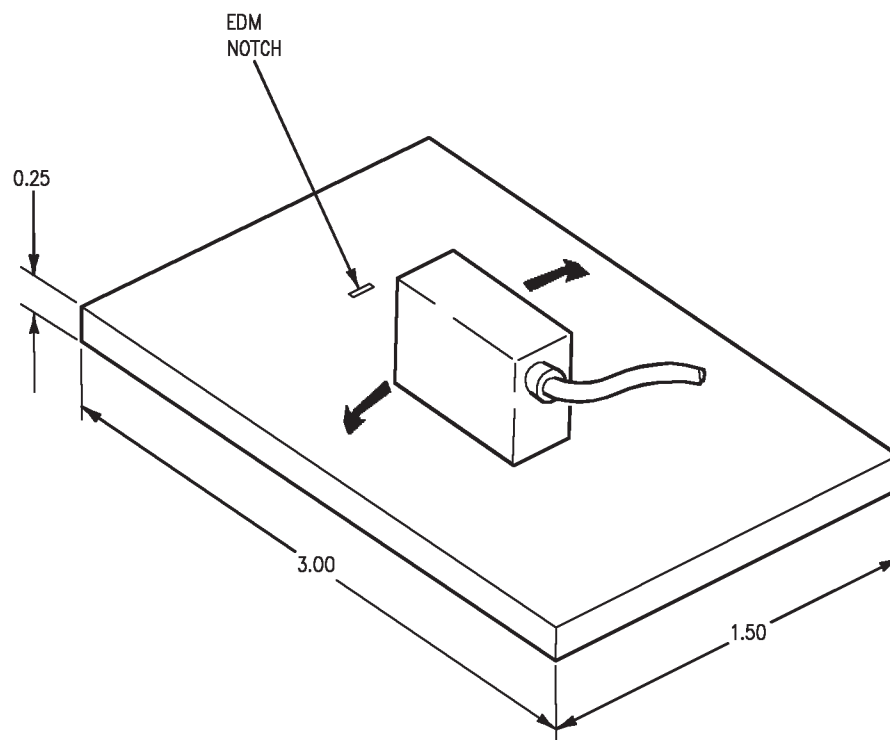


**Figure 1. Main Landing Gear Lever Assembly Inspection Areas**

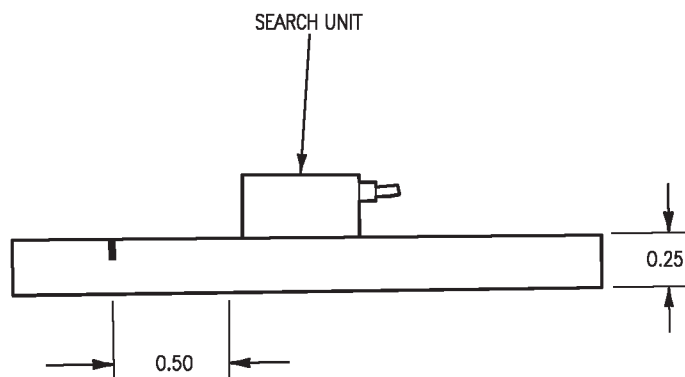




**Figure 2. Components Removed For Inspection**

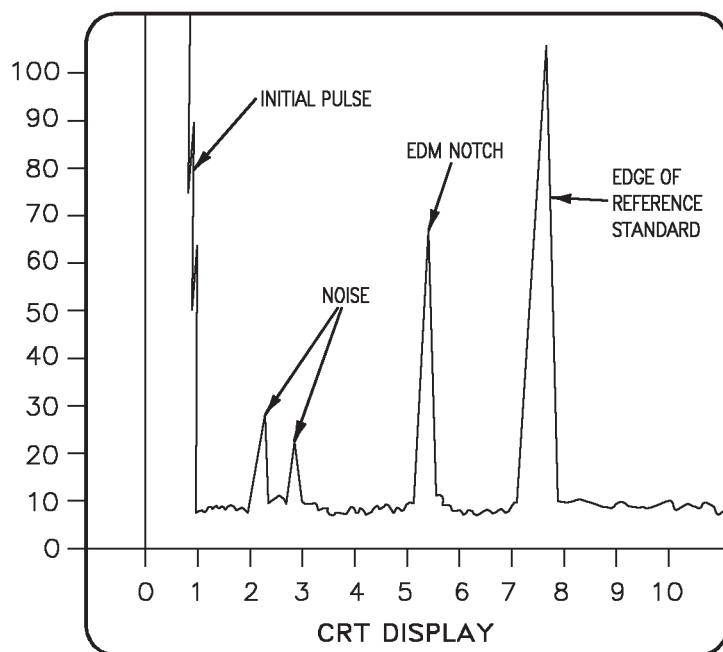


SWIVEL SEARCH  
UNIT TO MAXIMIZE  
RESPONSE

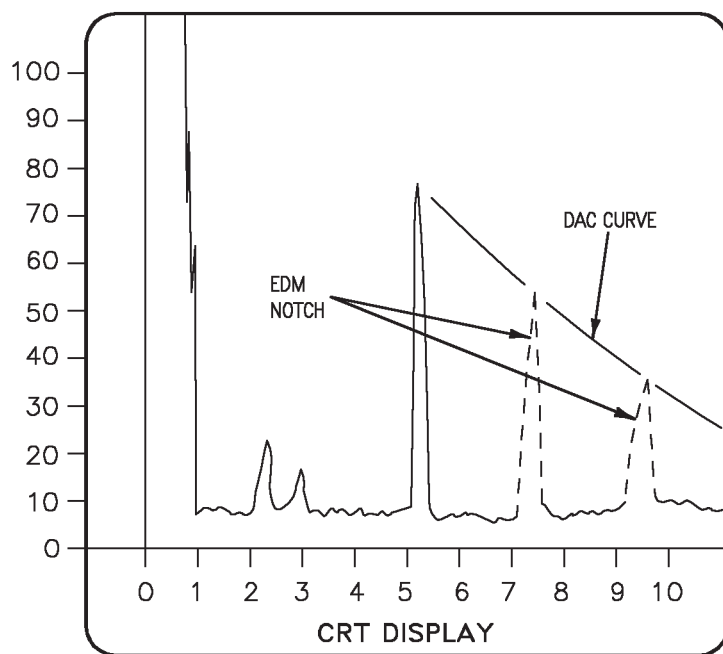


SURFACE WAVE  
INSPECTION

Figure 3. Ultrasonic Reference Standard

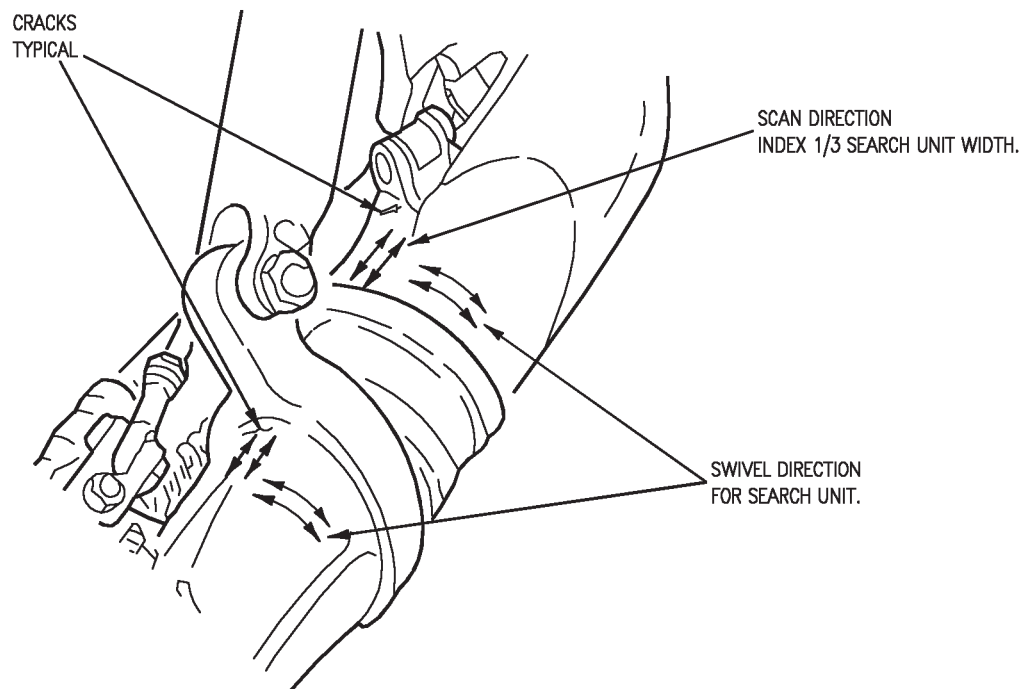


CRT 1



CRT 2

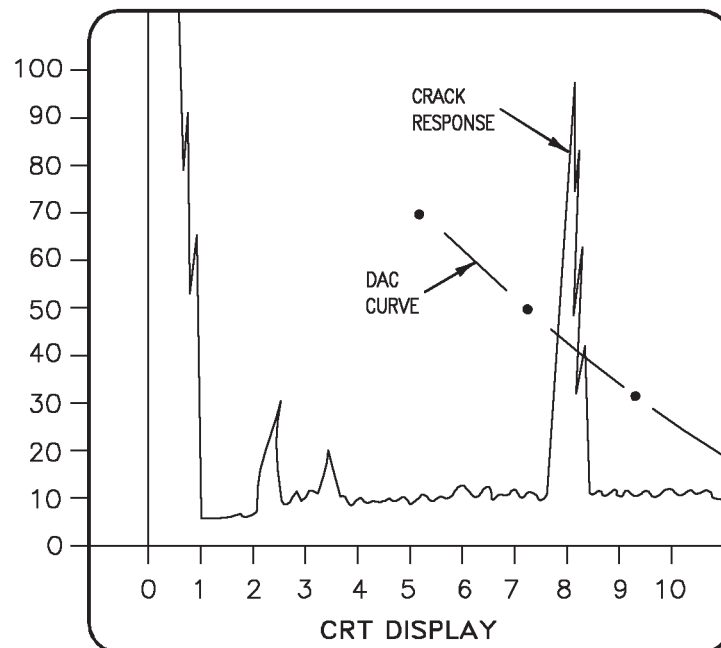
Figure 4. Standardization Using C-398 Ultrasonic Flaw Detector



# LEGEND

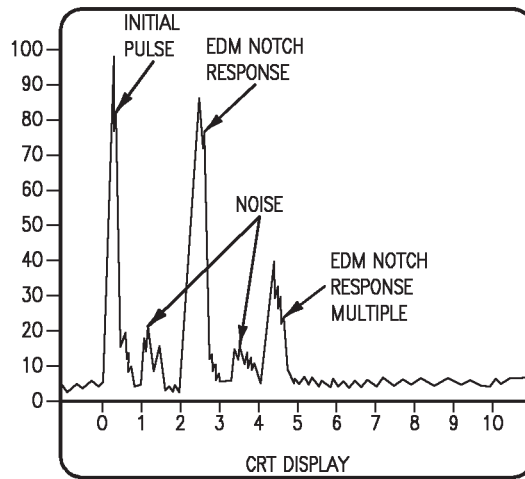
SEE FIGURE 1  
FOR INSPECTION AREAS.

Figure 5. Ultrasonic Scan



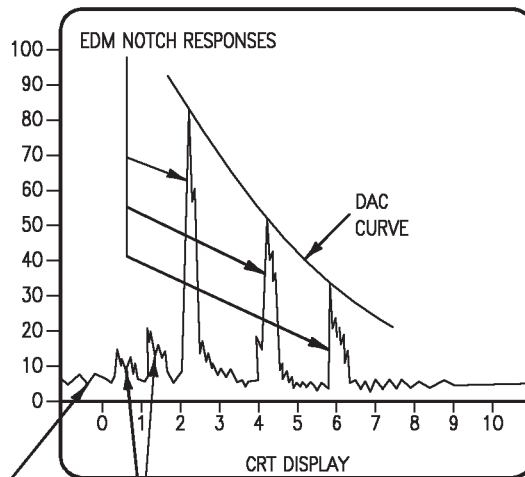
CRT 1

Figure 6. Rejectable Crack Response Using C-398 Ultrasonic Flaw Detector



CRT 1

RESPONSE FROM EDGE OF REFERENCE STANDARD MAY ALSO BE VISIBLE. EDM NOTCH RESPONSE MULTIPLE MAY OR MAY NOT BE VISIBLE.



CRT 2

EDM NOTCH RESPONSE MULTIPLES MAY ALSO BE VISIBLE.

ABSENCE OF INITIAL PULSE. INITIAL PULSE MAY BE MOVED OFF-SCREEN DURING STANDARIZATION

Figure 7. Standardization Using MUX-715/E Ultrasonic Flaw Detector

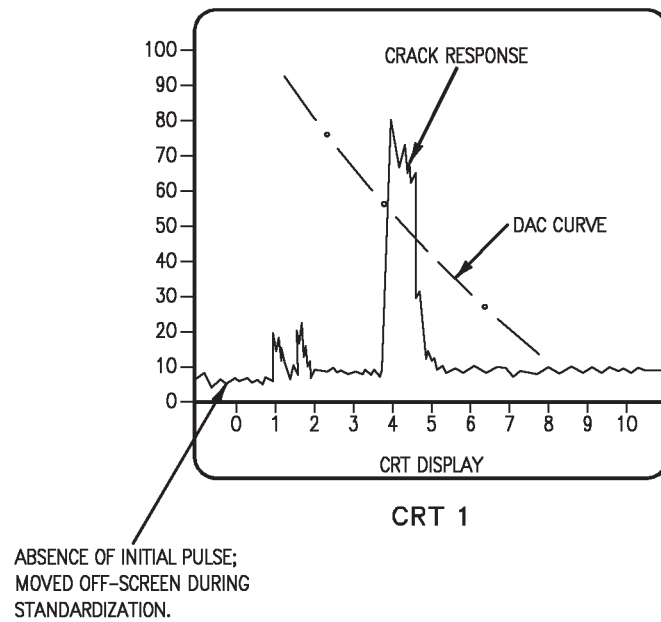


Figure 8. Rejectable Crack Response Using MXU-715/E Ultrasonic Flaw Detector





## INTERMEDIATE MAINTENANCE

## NONDESTRUCTIVE INSPECTION

## RESIDUAL STRESS MEASUREMENTS FOR MAIN LANDING GEAR LEVERS

PART NO. 74A410506

This WP supersedes WP069 05, dated 1 November 2001.

## Reference Material

Naval Aviation Maintenance Program .....	OPNAVINST 4790.2
Plane Captain Manual .....	A1-F18AC-PCM-000
Line Maintenance Procedures.....	A1-F18AC-LMM-000
Aircraft Weapons Systems Cleaning and Corrosion Control.....	NAVAIR 01-1A-509
Nondestructive Inspection Methods .....	NAVAIR 01-1A-16
Aircraft Corrosion Control.....	A1-F18AC-SRM-500
Cleaning.....	WP006 00
Stripping.....	WP007 00
Finish System .....	WP012 00
Troubleshooting Landing Gear and Related Systems.....	A1-F18AC-130-200
Testing Wheelbrake and Anti Skid Systems .....	WP008 00
Landing Gear and Related Systems.....	A1-F18AC-130-300
MLG Axle Lever Assembly and MLG Lever Swing Joint Support .....	WP040 00
Special/Preservation Maintenance Requirements Cards	
(F/A-18A and F/A-18B) .....	A1-F18AC-MRC-250
Special/Preservation Maintenance Requirements Cards	
(F/A-18C and F/A-18D) .....	A1-F18AE-MRC-250

## Alphabetical Index

Subject	Page No.
Main Landing Gear Lever .....	2
Defects .....	2
General Information .....	2
Post Inspection Cleaning and Corrosion Control.....	7
Primary Inspection Method .....	2
Safety Precautions .....	4
System Securing.....	8

## Record of Applicable Technical Directives

Type/ Number	Date	Title and ECP No.	Date Incorp.	Remarks
F/A-18 AFB 113 Rev. A Amend 2	22 Apr 87	Inspection of Main Landing Gear (MLG) Axle Assy	1 Aug 88	-

## 1. MAIN LANDING GEAR LEVER.

## NOTE

2. Main landing gear lever (lever assembly) is machined 300 M steel forging. External surface is IVD aluminum coated or cadmium plated. Finish system is epoxy primer and enamel top coat. Internal surface is cadmium plated and coated with epoxy.

This inspection requires the aircraft to be in a "gear down - weight off wheels" position before inspection. A MLG lever that has been removed from the aircraft may also be inspected using this procedure.

3. **GENERAL INFORMATION.** Residual stresses in specified areas of lever assemblies is measured using ROLLSCAN magnetoelastic device which senses Barkhausen noise. Barkhausen noise is affected by state of stress and microstructure, and can be used to determine residual surface stress when microstructure is controlled. Barkhausen noise which is generated by material under the affect of an externally applied AC field, is detected and calibrated to produce output of magnetoelastic parameter units (MPU). Sensor assembly used to apply external field and sense Barkhausen noise MPU value is sensitive to lever magnetization, pole orientation, and sensor location.

It is acceptable to raise the aircraft to a height that will allow the post inspection operational check to be done without re-jacking.

4. **DEFECTS.** Inspect lever assembly for residual, outer surface stress.

8. **Access.** No special access required.

## Support Equipment Required

## NOTE

Alternate item type designations or part numbers are listed in parentheses.

\* annotated items are contained in 74D110068-1001 and 74D130509-1001, magnetic inspection support equipment.

5. **PRIMARY INSPECTION METHOD.** The primary inspection method is magnetoelastic (Barkhausen noise) measurement.

6. **Personnel Qualifications.** Personnel doing this nondestructive inspection should be qualified and certified to do ROLLSCAN, magnetoelastic measurement inspections per OPNAVINST 4790.2 SERIES, NDI Technicians, NEC 7225/MOS 6044.

7. **Preparation of Aircraft.** Have aircraft prepared for jacking (A1-F18AC-LMM-000). Jack aircraft so that all landing gear wheels clear the floor.

## Part Number

## or Type Designation

## Nomenclature

*200-2 (100-2)	ROLLSCAN 200-2 System (ROLLSCAN 100-2 System)
*S1-136-1 (S1-109-1)	Medium, General Purpose Sensor
Model 25	Magnetometer with +/-5 Gauss
*MCAIR No. 1 Through No. 35	Residual Stress Reference Standard

**Materials Required****Specification  
or Part Number****Nomenclature**

CCC-C-440 TY1 CL1	Cheesecloth
MILR81294TY1CL1 (CAGE 81349)	Remover, Paint
MIL-A-9962TY1CL1 GRB SZ 9x11 (CAGE 80244)	Mat, Abrasive
MIL-B-131 CL 1	Barrier Material
MIL-C-85054 TY1 (CAGE 80244)	Amlguard
MIL-C-85570 TY2	Cleaning Compound
MIL-T-23397TY2 020X413	Tape, Adhesive
	Cleaning Solvent
-	Scraper, Plastic



Do not use abrasive means to remove finish in the inspection area, inaccurate responses will occur. Plastic scrapers are acceptable. Metal scrapers, sanding, grit blasting, ceramic or glass bead stripping, and so on are strictly prohibited. Contact Engineering for disposition if the inspection area has any of the following conditions; the coating system has been removed with abrasive means, the plating has been removed exposing 300M steel, or corrosion/pits have developed. Any of these conditions invalidate this inspection method.

f. Locate inspection areas A and B, see figure 1.

**9. Preparation of Part.**

a. Have electrical and hydraulic power removed (A1-F18AC-LMM-000).

b. Have applicable safety and protective devices installed (A1-F18AC-PCM-000).

c. On left and right lever assemblies have 74A411552-1011, 74A411555-1011, 74A411558-1011, and 74A411561-1011 brake hydraulic tube assemblies removed (A1-F18AC-130-300, WP040 00).

d. Have 74A756201-98NA and 74A756202-98NA electrical cable assemblies removed and tied back from inspection area (A1-F18AC-130-300, WP040 00).

e. Have MS35842-16 clamps removed (A1-F18AC-130-300, WP040 00).

g. Protect surfaces next to inspection area using barrier material and adhesive tape.

**WARNING**

Cleaning compound is flammable liquid and vapor. May cause allergic respiratory and skin reaction. May cause eye, skin and respiratory irritation. Keep away from heat, sparks, and flame. Do not breathe dust (vapor, mist, gas). Use only with enough ventilation. Keep container closed. Avoid contact with eyes, skin and clothing. Wash thoroughly after handling.

h. Remove any amlguard from inspection area using cleaning cloth moistened with cleaning compound. Allow surface to air dry 15 minutes.

**WARNING**

Paint remover is toxic. Avoid breathing of vapors. Avoid contact with skin or eyes. Wear gloves and goggles while handling. If eye contact is made, wash immediately with large amount of water. If skin contact is made, wash immediately with soap and water.

**CAUTION**

Make sure paint remover does not contact surfaces next to inspection area, damage to finish system will result.

i. Using paint remover have finish system chemically removed (A1-F18AC-SRM-500, WP007 00) from inspection areas, see figure 1, sheet 2 and 3, and enough of the surrounding area to allow a complete inspection of the location specified.

**WARNING**

The cleaning solvent may be flammable and/or toxic. Follow safety precautions applicable to solvent used. Skin and eye protection may be required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

j. Clean all foreign matter, grease, and oil from inspection areas using cheesecloth moistened with an environmentally compliant solvent. Wipe surface dry with clean cheesecloth before solvent evaporates.

k. Make sure jacks have been sufficiently raised to seat jacks in jack pads (A1-F18AC-LMM-000).

l. Bleed off nitrogen from left/right shock absorber (A1-F18AC-LMM-000).

10. **SAFETY PRECAUTIONS.** Make sure safety precautions have been met for electrical, static, grounding when using electrical equipment near aircraft fuel cells, oxygen systems, electronic systems, and stores (A1-F18AC-PCM-000).

# 11. Equipment Settings/Standardization/Setup for ROLLSCAN 200-2 or ROLLSCAN 100-2.

**NOTE**

This is a lift-and-place type inspection. A continuous scan will not give accurate readings. For future reference, the term "scan" will refer to a point-by-point inspection.

a. Attach the medium general purpose sensor probe to the **SENSOR** port located on front face of ROLLSCAN unit.

**CAUTION**

Do not leave the unit "on" and unattended for extended lengths of time (more than 30 minutes). Tips of probe will heat up and provide inaccurate readings.

b. Push **POWER** switch to "on", and allow 5 minutes of warm up time.

c. Set front face settings:

**ROLLSCAN 200-2**

CH1.....	44
CH2.....	N/A
MAGN.....	90
MEAS.....	ON (Button Light ON)
FREQ.....	HIGH
DISPLAY.....	CH1

**ROLLSCAN 100-2**

MAGN.....	90
MEAS.....	ON (Button Light ON)
DISPLAY .....	0 DEG (Button IN)
RANGE.....	2
FREQ.....	HIGH

d. With sensor assembly held in the air record DISPLAY output. If output is greater than 10 MPU's have area cleared of all other operating electrical instruments and repeat air point measurement. Failure to get air point below 10 MPU's may result in inaccurate measurements.

## NOTE

Do not rotate sensor assembly more than  $\pm 10^\circ$  from the longitudinal axis of the reference standard. The orientation of the probe directly effects the response. The longitudinal direction contains the maximum tensile stress and is the reading of importance.

e. Position sensor assembly on center of concave surface of F/A-18A/B/C/D reference standard so magnetized pole pieces and sensor are aligned with longitudinal axis of standard, see figure 3.

## NOTE

Caution should be used to make sure the probe is squarely on the surface to be inspected. A slight tilt to the probe will give false readings.

f. Make sure that the probe is squarely on the inspection surface and maximize the output by slight probe rotations and/or rocking. Note the maximum sustained MPU value on the Rollscan Display. Wait for the maximum MPU value to stabilize.

g. When stable maximum values are achieved, inspect again to make sure that the probe is located squarely on the standard.

h. If output values are not within tolerance,  $\pm 2^\circ$  MPU's of reference standard values;

(1) Clear **DISPLAY** by pressing **MEAS** button.

(2) Visually inspect reference standard, sensor assembly, and Rollscan unit for contamination or damage.

(3) If no equipment problems are found:

(a) ROLLSCAN 100: Equipment adjustment not permitted in the field.

(b) ROLLSCAN 200: Adjust CH1 setting to get MPU output within  $\pm 2^\circ$  MPU's.

(4) If tolerance cannot not be met and no equipment problems are found, this inspection may not be done with this equipment. Contact Depot Engineering for further disposition.

## 12. Lever Assembly Residual Stress Limits.

Maximum allowable magnetoelastic measurement is:

a. IVD aluminum coated lever assemblies - 90 MPU's in area A.

b. IVD aluminum coated lever assemblies - 140 MPU's in area B.

c. Cadmium plated lever assemblies - 200 MPU's in areas A and B.

d. Inspect the MLG axle IAW (A1-F18AC-MRC-250 or A1-F18AE-MRC-250) if the L/R MLG lever assembly fails the rollscan inspection and requires removal and replacement.

## 13. Inspection Procedure.

a. Locate the inspection areas A and B, see figures 1 and 2.

## NOTE

Before making any magnetoelastic measurements, be sure inspection area and near by areas do not have residual magnetic field strength greater than 3 gauss.

b. Use magnetometer to inspect for residual magnetic field. If magnetic field of 3 gauss or more are found demagnetize (NAVAIR 01-1A-16).

c. Recommend that the inspector locate, and inspect a grid of dots on the part that are approximately 1/8 inch apart (this grid should cover the whole inspection area). During the first inspection pass, it is recommended that the probe be oriented to measure the residual stress defined in figure 2 as the "Major Stress Direction". This will aid in narrowing down the area containing the maximum tensile stress. As the location is narrowed down, more thoroughly inspect the area looking for the peak tensile stress using different probe orientations.

**NOTE**

The response for any given point will change depending on the orientation of the probe to the residual stresses. Use the "Major Stress Direction" arrows found in figure 2 as a starting orientation to initially align the probe in the inspection area. When aligned, scan the immediate area with  $\pm 30^\circ$  of rotation. This will aid in making sure that the maximum value in the area of interest is found.

d. Completely investigate the inspection locations found in figure 2. For each inspection location, record the maximum sustainable MPU value achieved and its orientation on a copy of figure 4. Also include Aircraft Bureau Number, lever P/N, S/N, total flight hours, total landings, number of carrier landings, (specially hard landings), date of inspection, inspector's printed name and other pertinent data regarding MLG maintenance. File this copy in the aircraft maintenance logbook. If the residual stress levels exceed the acceptable limit, as found in paragraph 12, attach a second copy of figure 4 to paperwork of BCM component.

(1) ROLLSCAN 100: If **DISPLAY** output flashes off and on, or reads 199, reset **RANGE** control to "1". If **RANGE** is set to "1" multiply the **DISPLAY** value by 2 before recording as MPU's.

(2) ROLLSCAN 200: IF **DISPLAY** output flashes off and on, or reads 199, adjust CH1 gain setting to 1/2 starting value. If starting value is an odd number, round up to next highest even number before dividing the gain setting in half. If the CH1 setting is adjusted in this way, multiply the **DISPLAY** value by 2 before recording as MPU's.

e. Determine if lever assembly's surface treatment is IVD aluminum or cadmium plating by using table 1. If unsure of the surface treatment, test per table 2. The plating type will effect the acceptance criteria in paragraph 12.

**WARNING**

Caustic materials are hazardous; follow applicable safety precautions.

**Table 1. MLG Axle Lever P/N / Dash No. and Plating Type.**

P/N / Dash No.	Plating Type
74A410506-1001 / -2003	IVD Aluminum
-1002 / -2004	
-1003 / -2005	
-1004 / -2006	
-1007 / -2005	
-1008 / -2006	
-1005 / -2009	IVD Aluminum or Cadmium
-1006 / -2010	
-1009 / -2011	Cadmium
-1010 / -2012	
-1011 / -2015	
-1012 / -2016	

**NOTE**

For P/N's 74A410506-1005/-2009 and -1006/-2020, the finish system was changed from IVD aluminum to cadmium plate with implementation at manufacturing convenience. For that reason either Cad or IVD aluminum may exist on these dash numbers.



Table 2. Determination of MLG Plating.

Solution Application	Application / Dwell Time	Reactions
Apply one drop 12 % Ammonium Nitrate followed by one drop of 10 % Sodium Sulfide	60 Seconds (Ammonium Nitrate) 5 seconds (Sodium Sulfide)	<b>If Cadmium:</b> Will result in a yellow precipitate. <b>If IVD Aluminum:</b> No color change.
Apply one drop 1 % Silver Nitrate. (Solution is light sensitive, store in dark colored bottle)	5 Seconds	<b>If Cadmium:</b> Will turn dark or black. <b>If IVD Aluminum:</b> No color change.
Apply one drop 10 % Sodium Hydroxide	5 Seconds	<b>If Cadmium:</b> No color change. <b>If IVD Aluminum:</b> Will turn milky white.
<b>NOTES:</b>  1. Solutions listed from top to bottom in order of preference.  2. Solutions must be rinsed off immediately after plating determination and the part must be dried immediately after rinsing.		

#### 14. POST INSPECTION CLEANING AND CORROSION CONTROL.



Do not sand bare metal area, stresses will be set up in lever assembly.

#### WARNING

Cleaning compound is flammable liquid and vapor. May cause allergic respiratory and skin reaction. May cause eye, skin and respiratory irritation. Keep away from heat, sparks, and flame. Do not breathe dust (vapor, mist, gas). Use only with enough ventilation. Keep container closed. Avoid contact with eyes, skin and clothing. Wash thoroughly after handling.

a. Clean area using cleaning cloth moistened with cleaning compound. Rinse with clean water and dry immediately with new cleaning cloth.

b. If all lever Rollscan measurements pass the criteria in paragraph 12 complete the following:

(1) With minimum pressure, use only a handheld, abrasive mat, wetted with water, to "feather" the paint edges.

(2) Solvent clean per (A1-F18AC-SRM-500, WP006 00) using an environmentally approved solvent to remove residue caused by feathering edges of finish system.

(3) Make sure all water has been removed from inspection areas using an F/A-18A/B/C/D approved paint system per (A1-F18AC-SRM-500, WP012 00).

## WARNING

Amlguard is flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

c. If any of the magnetoelastic measurements exceed the limits in paragraph 12, apply amlguard using a brush to inspection areas (NAVAIR 01-1A-509). This is for temporary protection only.

## CAUTION

It is not acceptable to fly an aircraft with only amlguard protecting the landing gear from corrosion.

### 15. SYSTEM SECURING.

a. Have MS35842-16 clamp, reinstalled (A1-F18AC-130-300, WP040 00).

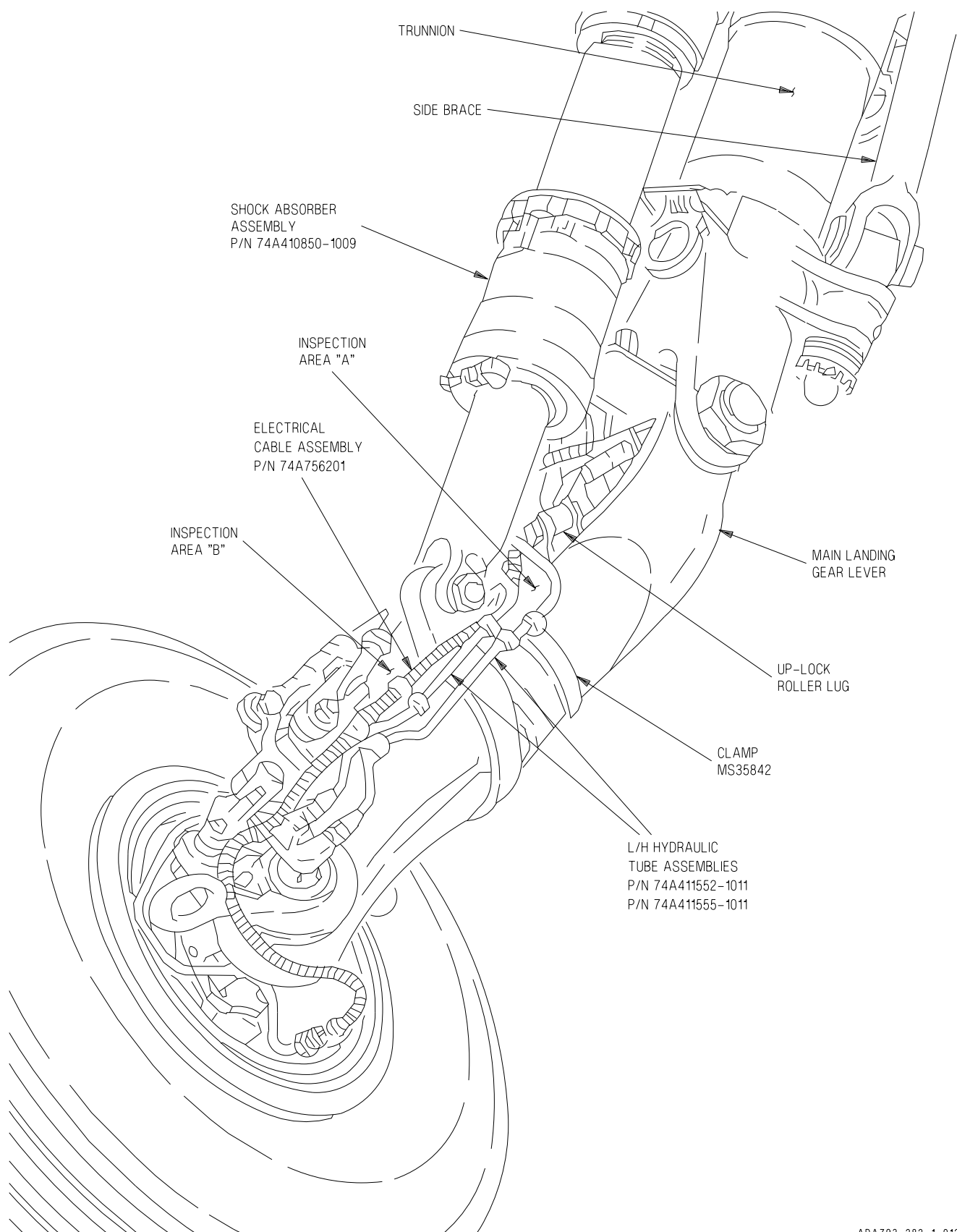
b. Have 74A756201-98NA and 74A756202-98NA electrical cable assemblies reinstalled (A1-F18AC-130-300, WP040 00).

c. On left and right lever assembly, have 74A411552-1011, 74A411555-1011, 74A411558-1011, and 74A411561-1011 brake hydraulic tube assemblies reinstalled (A1-F18AC-130-300, WP040 00).

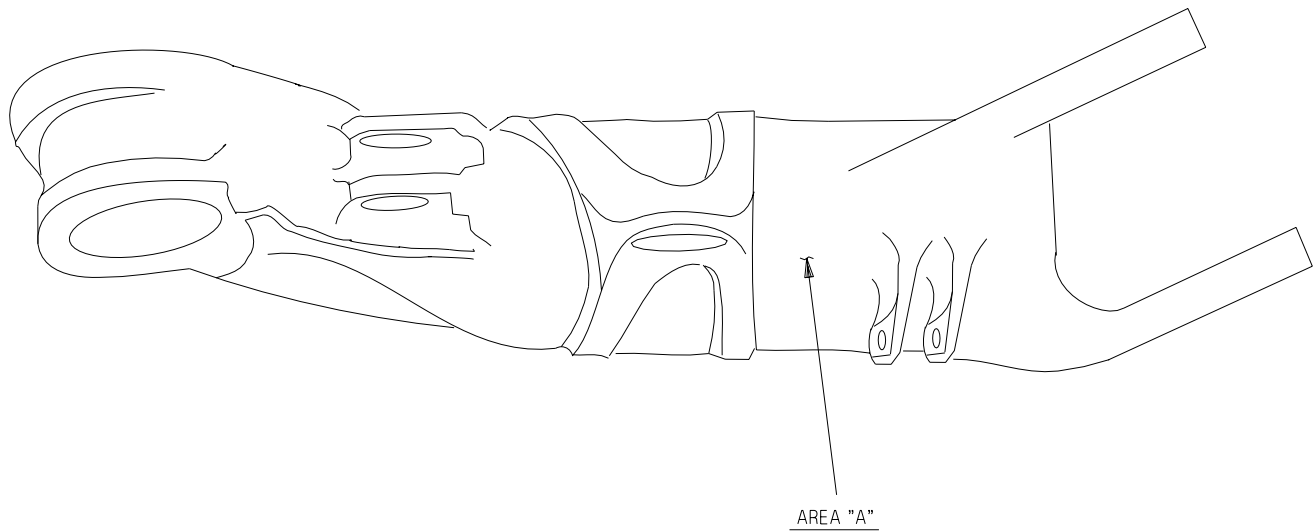
d. Have shock absorber reserviced (A1-F18AC-LMM-000).

e. Have wheelbrake inspection done (A1-F18AC-130-200, WP008 00).



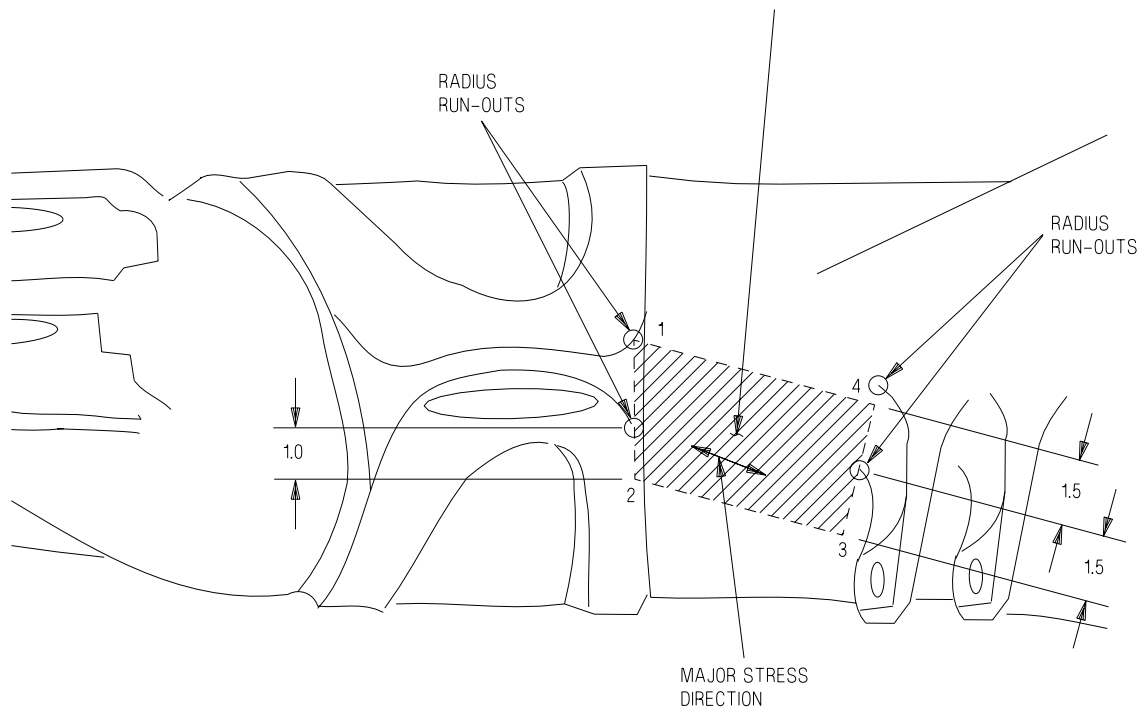


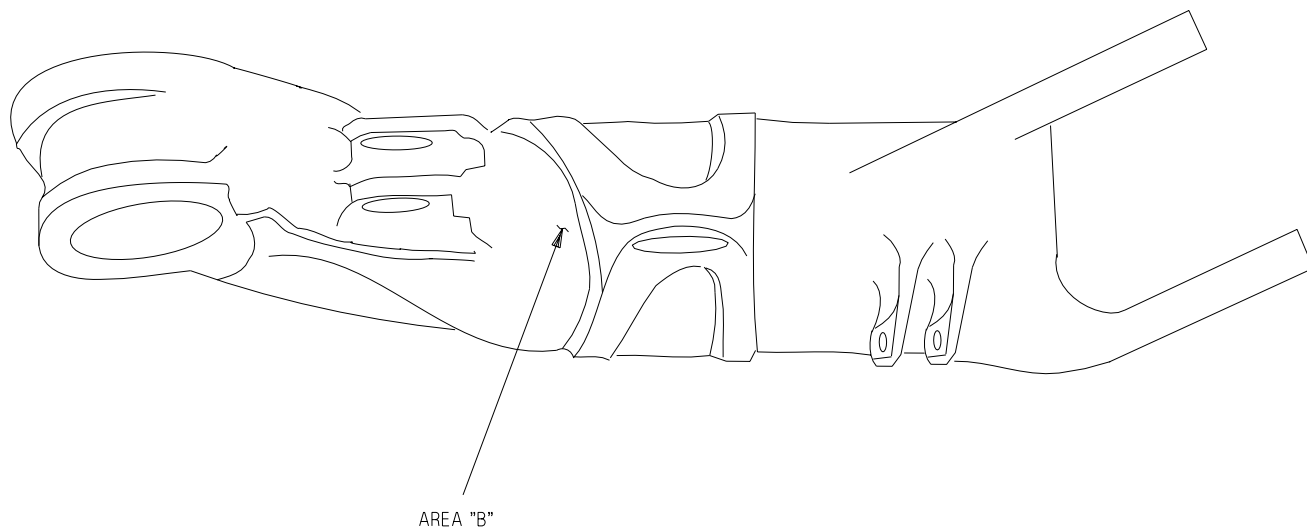
**Figure 1. L/H Main Landing Gear Lever P/N 74A410506 Inspection Locations (Sheet 1)**



THIS AREA IS MOST EASILY FOUND BY LOCATING THE FOUR CORNER POINTS OF THE QUADRANGLE.

- 1) LOCATE THE TWO FORWARD RADIUS RUN-OUTS ON THE SHOCK ABSORBER ATTACH LUG AND DRAW A LINE BETWEEN THEM.  
 A) CORNER #1 IS LOCATED AT THE OUTBOARD RADIUS RUN-OUT.  
 B) CORNER #2 IS LOCATED 1 INCH FROM THE INBOARD RADIUS RUN-OUT.
- 2) LOCATE THE TWO RADIUS RUN-OUTS OF THE UP-LOCK ROLLER LUG AND DRAW A LINE BETWEEN THEM.  
 A) CORNER #3 IS LOCATED 1.5 INCHES INBOARD FROM THE RADIUS RUN-OUT.  
 B) CORNER #4 IS LOCATED 1.5 INCHES OUTBOARD FROM THE RADIUS RUN-OUT.
- 3) THE INSPECTION AREA IS ENCLOSED BY THE LINES AS SHOWN.

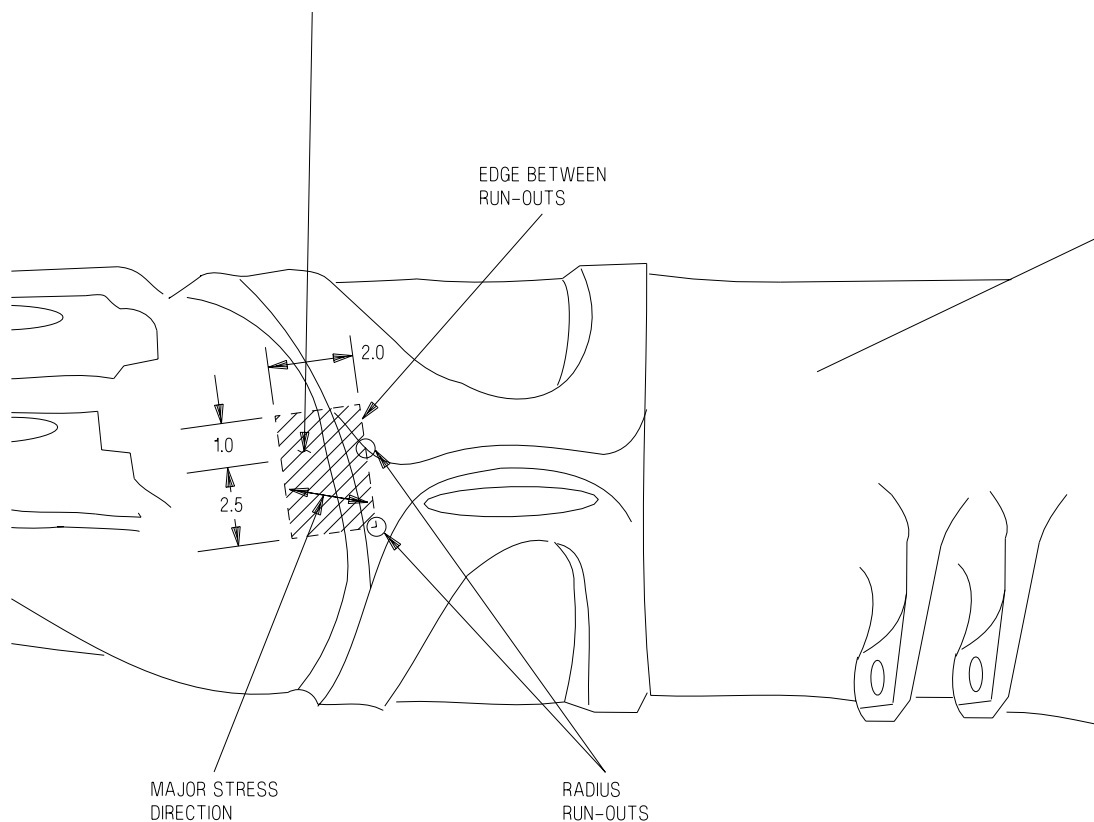


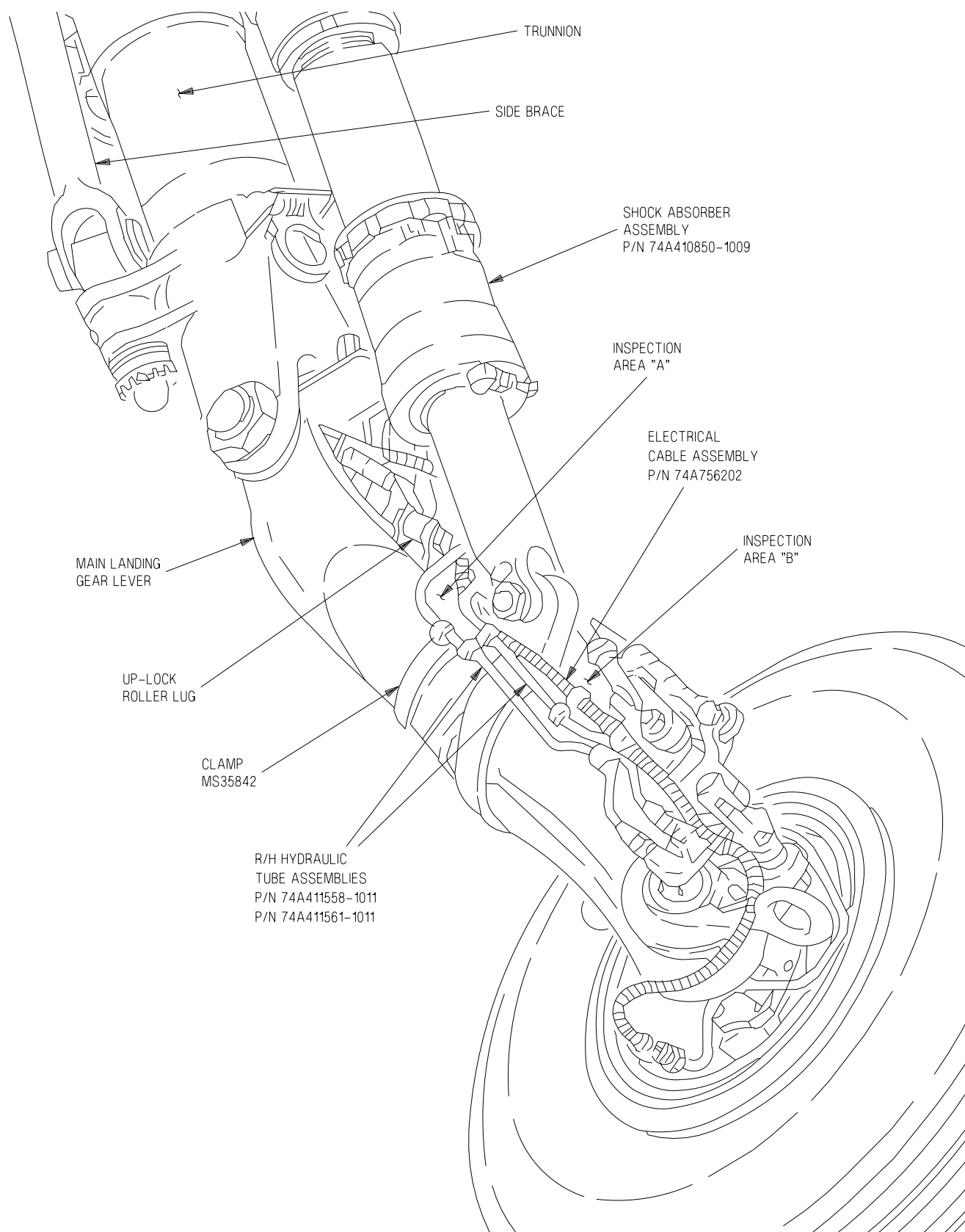


AREA "B"

THIS AREA IS MOST EASILY FOUND BY LOCATING THE FORWARD EDGE OF THE INSPECTION AREA AND MEASURING AFT.

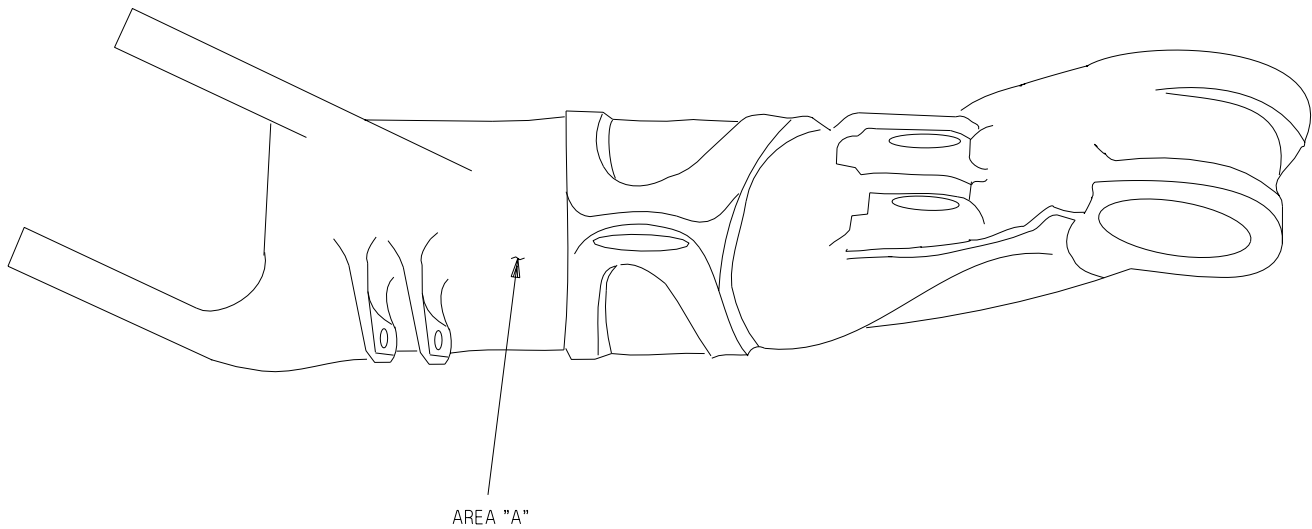
- 1) LOCATE THE TWO AFT RADIUS RUN-OUTS ON THE SHOCK ABSORBER ATTACH LUG AND DRAW A LINE BETWEEN THEM (APPROX. 2.5 INCHES).
- 2) EXTEND THE LINE 1 INCH BEYOND THE OUTBOARD RADIUS RUN-OUT.
- 3) ENCLOSE A RECTANGLE THAT USES THIS LINE AND IS 2 INCHES WIDE (AS SHOWN BELOW) TO FIND THE WHOLE INSPECTION AREA.





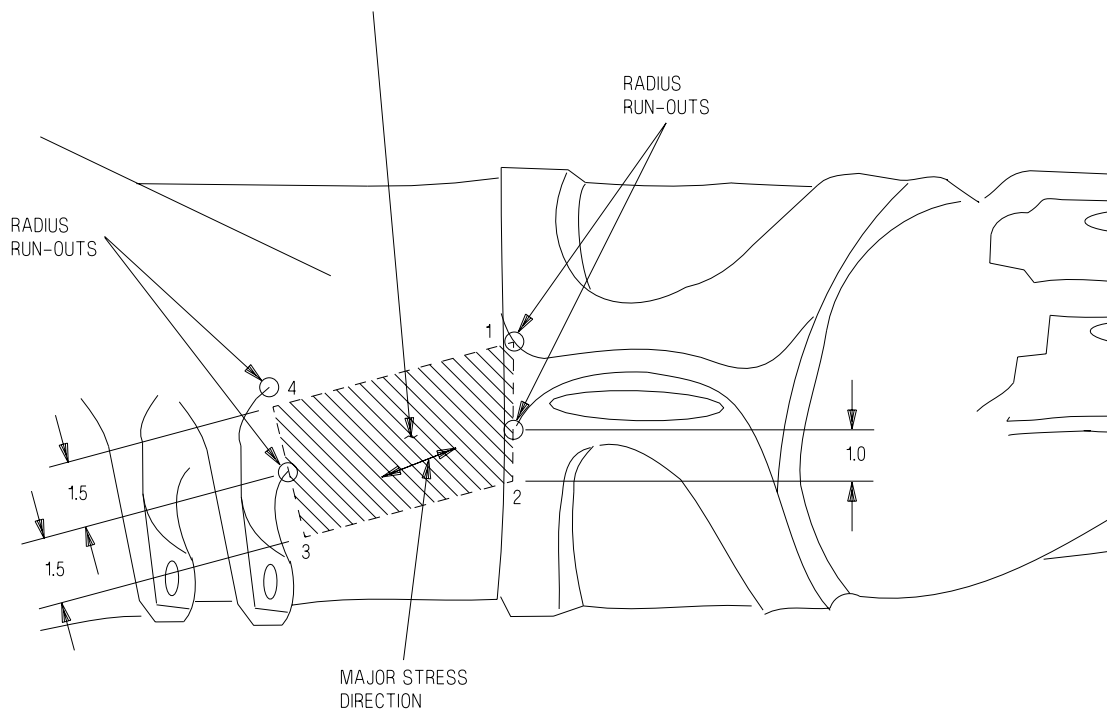
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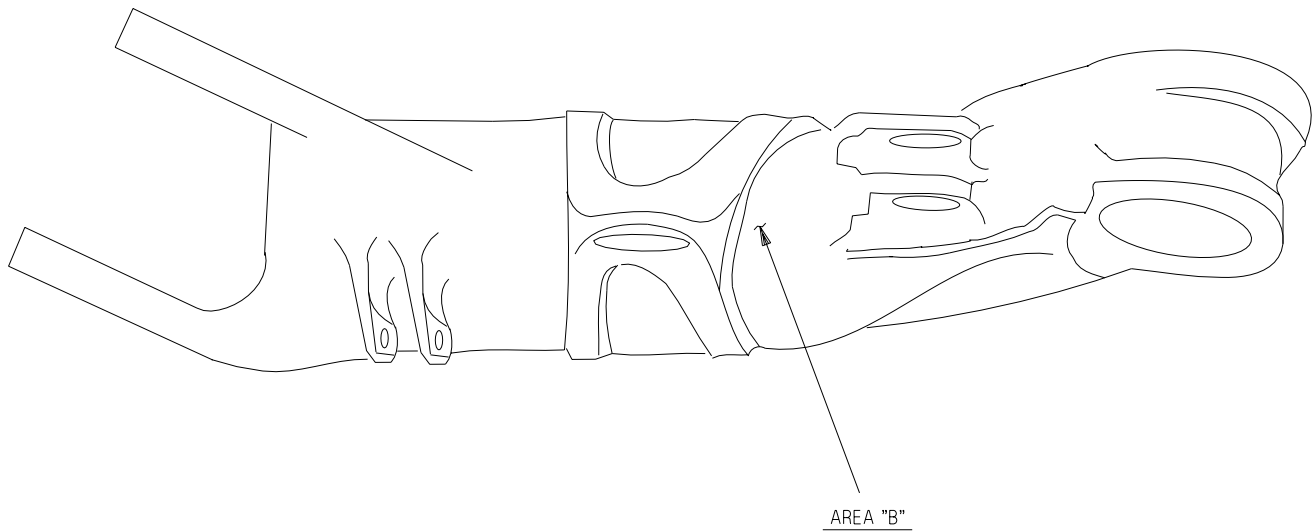
**Figure 2. R/H Main Landing Gear Lever P/N 74A410506 Inspection Locations (Sheet 1)**



THIS AREA IS MOST EASILY FOUND BY LOCATING THE FOUR CORNER POINTS OF THE QUADRANGLE.

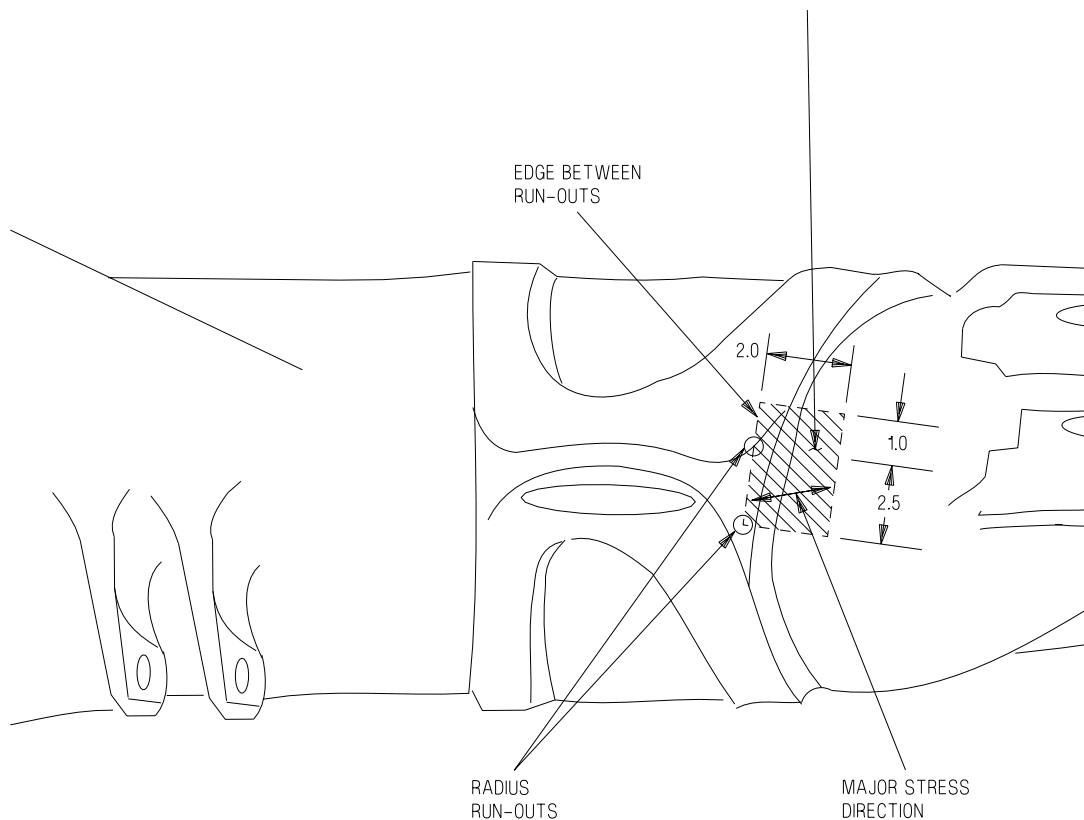
- 1) LOCATE THE TWO FORWARD RADIUS RUN-OUTS ON THE SHOCK ABSORBER ATTACH LUG AND DRAW A LINE BETWEEN THEM.
  - A) CORNER #1 IS LOCATED AT THE OUTBOARD RADIUS RUN-OUT.
  - B) CORNER #2 IS LOCATED 1 INCH FROM THE INBOARD RADIUS RUN-OUT.
- 2) LOCATE THE TWO RADIUS RUN-OUTS OF THE UP-LOCK ROLLER LUG AND DRAW A LINE BETWEEN THEM.
  - A) CORNER #3 IS LOCATED 1.5 INCHES INBOARD FROM THE RADIUS RUN-OUT.
  - B) CORNER #4 IS LOCATED 1.5 INCHES OUTBOARD FROM THE RADIUS RUN-OUT.
- 3) THE INSPECTION AREA IS ENCLOSED BY THE LINES AS SHOWN.

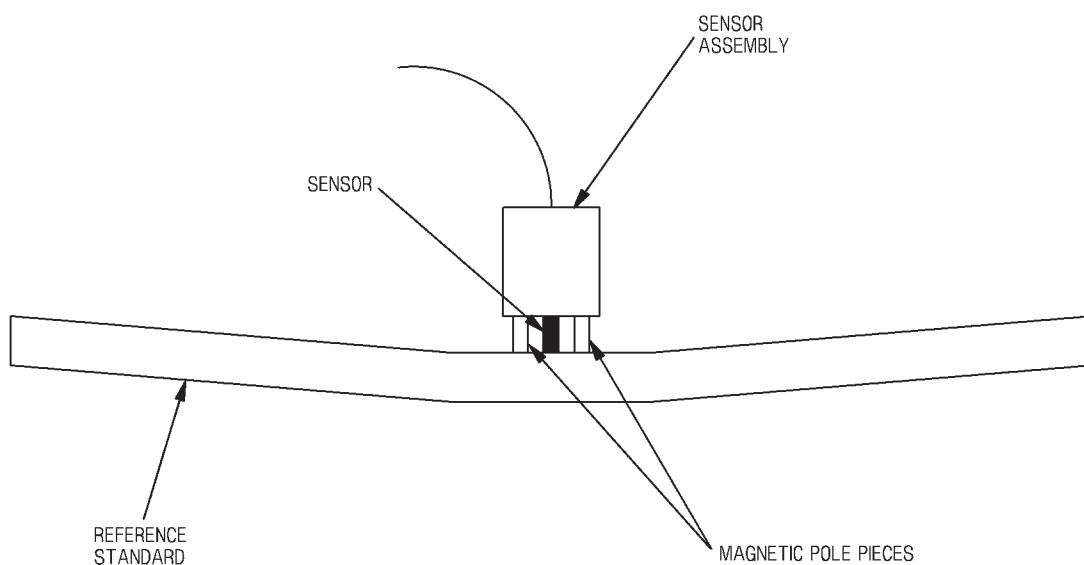
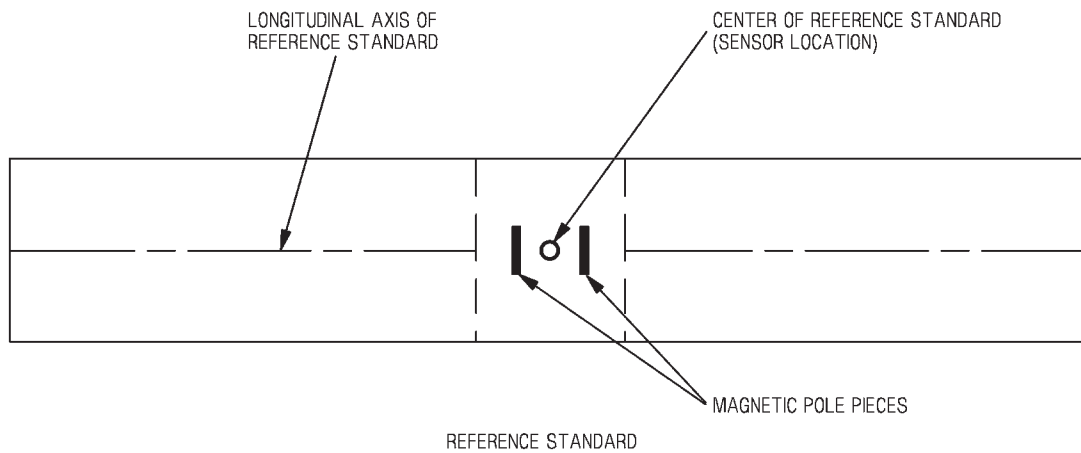




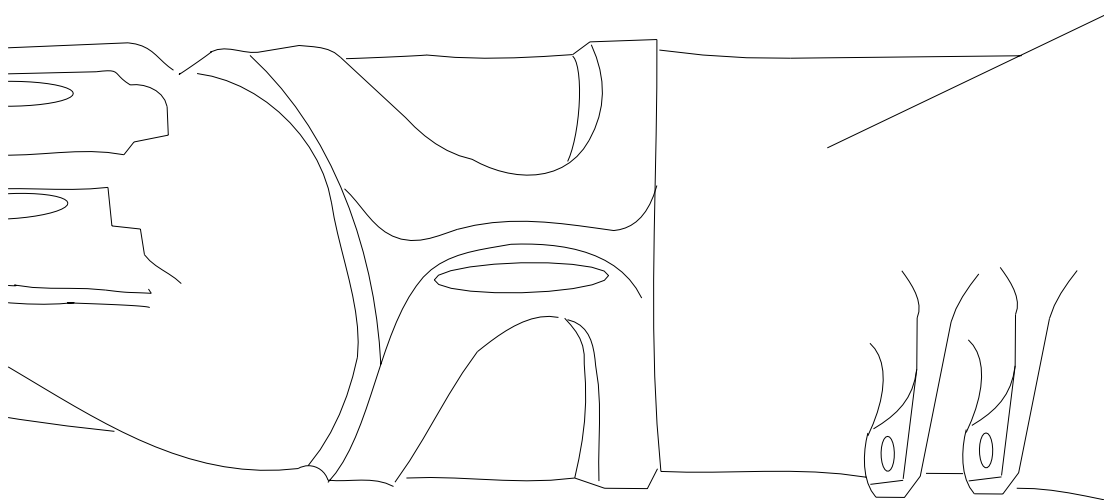
THIS AREA IS MOST EASILY FOUND BY LOCATING THE FORWARD EDGE OF THE INSPECTION AREA AND MEASURING AFT.

- 1) LOCATE THE TWO AFT RADIUS RUN-OUTS ON THE SHOCK ABSORBER ATTACH LUG AND DRAW A LINE BETWEEN THEM (APPROX. 2.5 INCHES).
- 2) EXTEND THE LINE 1 INCH BEYOND THE OUTBOARD RADIUS RUN-OUT.
- 3) ENCLOSE A RECTANGLE THAT USES THIS LINE AND IS 2 INCHES WIDE (AS SHOWN BELOW) TO FIND THE WHOLE INSPECTION AREA.





**Figure 3. Medium General Purpose Sensor Assembly Locating and Orientation on the F/A-18A/B/C/D Reference Standard**



☐ LEFT-HAND LEVER

ILLUSTRATE THE LOCATION, THE ORIENTATION, AND THE MAXIMUM MPU VALUE ACHIEVED IN BOTH INSPECTION AREAS.

LEVER PART NO. \_\_\_\_\_

LEVER SERIAL NO. \_\_\_\_\_

GEAR ASSEMBLY NO. \_\_\_\_\_

NO. OF LANDINGS TOTAL \_\_\_\_\_

FIELD \_\_\_\_\_ CARRIER \_\_\_\_\_

T&G \_\_\_\_\_ FCLP \_\_\_\_\_

HARD LANDING HISTORY  
(CODE) (DATE)

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

SENSOR NO. \_\_\_\_\_

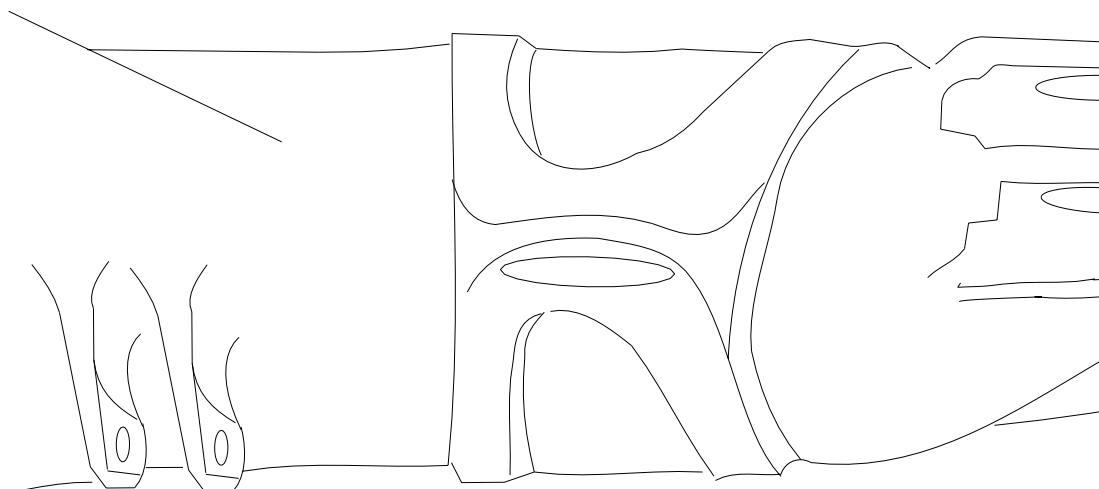
SQUADRON \_\_\_\_\_

INSPECTOR \_\_\_\_\_

BUREAU NO. \_\_\_\_\_

INSPECTION DATE \_\_\_\_\_





☐ RIGHT-HAND LEVER

ILLUSTRATE THE LOCATION, THE ORIENTATION, AND THE MAXIMUM MPU VALUE ACHIEVED IN BOTH INSPECTION AREAS.

LEVER PART NO. \_\_\_\_\_

LEVER SERIAL NO. \_\_\_\_\_

GEAR ASSEMBLY NO. \_\_\_\_\_

NO. OF LANDINGS TOTAL \_\_\_\_\_

FIELD \_\_\_\_\_ CARRIER \_\_\_\_\_

T&G \_\_\_\_\_ FCLP \_\_\_\_\_

HARD LANDING HISTORY  
(CODE) (DATE)

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

SENSOR NO. \_\_\_\_\_

SQUADRON \_\_\_\_\_

INSPECTOR \_\_\_\_\_

BUREAU NO. \_\_\_\_\_

INSPECTION DATE \_\_\_\_\_



## INTERMEDIATE MAINTENANCE

## NONDESTRUCTIVE INSPECTION

## MAIN LANDING GEAR TRUNNION, OUTBOARD POST, CRACKS

## PART NO. 74A410511-1015 THRU 1022

## Reference Material

Naval Aviation Maintenance Program .....	OPNAVINST 4790.2
Nondestructive Inspection Methods .....	NAVAIR 01-1A-16
Nondestructive Inspection.....	A1-F18AC-SRM-300
Penetrant Method.....	WP004 00
Magnetic Particle Method.....	WP006 00
Pulse-Echo Surface Wave, Contact of Metallic Materials.....	WP008 07
Plane Captain Manual .....	A1-F18AC-PCM-000
Aircraft Corrosion Control.....	A1-F18AC-SRM-500
Stripping.....	WP007 00
Finish System .....	WP012 00
Landing Gear and Related Systems.....	A1-F18AC-130-300
MLG Trunnion (12 MAP 585 or 12 MAR 586) .....	WP037 00
Aircraft Weapons System Cleaning and Corrosion Control .....	NAVAIR 01-1A-509

## Alphabetical Index

Subject	Page No.
Main Landing Gear Trunnion.....	1
Defects .....	1
Magnetic Particle Inspection.....	7
Penetrant Inspection .....	2
Post Inspection Cleaning and Corrosion Control.....	8
Primary Inspection Methods.....	2
Ultrasonic Method Using C-398 Ultrasonic Flaw Detector .....	3
Ultrasonic Method Using MXU-715/E Ultrasonic Flaw Detector .....	5

## Record of Applicable Technical Directives

None

## 1. MAIN LANDING GEAR TRUNNION.

2. Main landing gear trunnion (trunnion) is machined 300M steel forging. External surface is IVD, aluminum, coated or cadmium plated. Finish system is epoxy primer and enamel top coat.

Internal surface is coated with epoxy primer and thin layer of sealant.

3. **DEFECTS.** Inspect for external cracks in lower radius of trunnion post. See figure 1.

4. **PRIMARY INSPECTION METHODS.** Primary inspection methods are fluorescent penetrant and surface wave ultrasonics.

5. **Personnel Qualifications.** Personnel doing these nondestructive inspections should be qualified and certified to do fluorescent penetrant, ultrasonic, and magnetic particle inspections per OPNAVINST 4790.2 SERIES, NDI Technicians, NEC 7225/MOS 6044.

6. **Preparation of Aircraft.** No special preparation required.

7. **Access.** No special access required.

#### 8. PENETRANT INSPECTION.

##### Support Equipment Required

###### NOTE

Alternate item specifications or part numbers are shown indented.

Part Number or Type Designation	Nomenclature
ZA43 (XMA101 or TT10)	Portable Fluorescent Penetrant Inspection Kit
M-16	Black Light

##### Materials Required

Specification or Part Number	Nomenclature
MIL-I-25135	Inspection Penetrant
MIL-I-25135 DEVELOPER	Non-Aqueous, Developer
020X413	Cleaning Compound
M83953-1 or -2	Pencil, Aircraft Marking
CCCC46TY1CL4	Cloth, Cleaning

#### 9. Preparation of Part.

###### CAUTION

Make sure inspection areas are not mechanically worked with abrasive paper or files before initial penetrant inspection to avoid false indications.

a. Have finish system chemically removed from inspection area shown in figure 2 (NAVAIR 01-1A-509, NAVAIR 01-1A-16, and A1-F18AC-SRM-500, WP007 00).

###### WARNING

Cleaning compound is flammable liquid and vapor. May cause allergic respiratory and skin reaction. May cause eye, skin and respiratory irritation. Keep away from heat, sparks, and flame. Do not breathe dust (vapor, mist, gas). Use only with adequate ventilation. Keep container closed. Avoid contact with eyes, skin and clothing. Wash thoroughly after handling.

b. Clean inspection areas of any contamination or foreign material using cleaning cloth moistened with cleaning compound. Allow surface to air dry 15 minutes.

## 10. Inspection Procedure.

**WARNING**

Do not use prepenetrant etching on landing gear. Acid used for etching could cause embrittlement or corrosion of trunnion or other critical structure on MLG.

**CAUTION**

Penetrant inspection shall not be done at suspect crack indication area after abrasive material removal such as: grinding, sanding, or polishing. Smearing of material will result and interpretation of crack indication will not be possible.

- a. Do penetrant inspection on area shown in figure 1 per (WP004 00).
- b. Mark defect end points with sharp pointed aircraft marking pencil and record.
- c. If no crack(s) is found, do ultrasonic method paragraph 11 or 15.
- d. If crack(s) is found, have trunnion replaced (A1-F18AC-130-300, WP037 00) or notify depot for rework of parabolic fillet.
- e. After rework, do magnetic particle inspection per paragraph 19.

11. ULTRASONIC METHOD USING C-398  
ULTRASONIC FLAW DETECTOR.**Support Equipment Required****NOTE**

Alternate item type designations or part numbers are listed in parentheses.

Part Number or Type Designation	Nomenclature
C-398	Ultrasonic Flaw Detector
57A2271 or EQUIVALENT	Microdot to BNC Connecting Cable

**Support Equipment Required  
(Continued)****NOTE**

Alternate item type designations or part numbers are listed in parentheses.

Part Number or Type Designation	Nomenclature
57A3055 or EQUIVALENT	90°, 0.250 X 0.250 Inch, 5 MHZ, Contact Surface Wave Search Unit
74D110007-1001 (74SB2462)	Ultrasonic Reference Standard For Main Landing Gear Lever

**Materials Required**

Specification or Part Number	Nomenclature
ULTRAGEL II 020X413 M83953-1 or -2	Ultrasonic Couplant Cleaning Compound Pencil, Aircraft Marking
CCCC46TY1CL4 —	Cloth, Cleaning Clear Tape, Transparent Tape, Scotch Tape

**WARNING**

Cleaning compound is flammable liquid and vapor. May cause allergic respiratory and skin reaction. May cause eye, skin and respiratory irritation. Keep away from heat, sparks, and flame. Do not breathe dust (vapor, mist, gas). Use only with adequate ventilation. Keep container closed. Avoid contact with eyes, skin and clothing. Wash thoroughly after handling.

12. **Preparation of Part.** Remove inspection penetrant using cleaning cloth moistened with cleaning compound. Allow surface to air dry 15 minutes.

**WARNING**

Make sure safety precautions have been met for electrical, static, grounding when using ultrasonic equipment near aircraft fuel cells, oxygen systems, electrical systems, electronic systems, and stores (A1-F18AC-PCM-000).

**13. Equipment Setting/Standardization/Setup.**

a. Do general setup procedure per (WP008 07). Begin with initial equipment settings per (WP008 07) except as follows:

**NOTE**

Equipment differences may require use of alternate COARSE SWEEP RANGE, FREQ, REP RATE, FINE SWEEP RANGE, VIDEO DISPLAY, DAMPING and REJECT settings.

**COARSE SWEEP**

RANGE.....	2 INCHES
ATTENUATORS .....	2, 4, 8, 16 IN, 32 OUT
<b>COARSE SWEEP</b>	
DELAY.....	0-3 INCHES
FREQ.....	15 MHz
FINE GAIN.....	MID SCALE
COARSE GAIN .....	3 (APPROX)
<b>FINE SWEEP</b>	
RANGE.....	MID SCALE

**WARNING**

Ultrasonic couplant may cause eye irritation. Avoid contact with eyes. Wash thoroughly after handling.

b. Apply ultrasonic couplant to reference standard approximately 1.0 inch from EDM notch.

c. Position front edge of search unit 1.0 inch from EDM notch as shown in figure 3.

d. Maximize EDM notch response by swiveling search unit and removing excess ultrasonic couplant between search unit and EDM notch.

e. Adjust SWEEP RANGE so EDM notch response is located at 4 on CRT horizontal baseline. See figure 4, CRT 1.

f. Reposition search unit 2.0 inches from EDM notch and maximize response by swiveling search unit and removing excess ultrasonic couplant between search unit and EDM notch.

g. Apply ultrasonic couplant to reference standard approximately 1.0 inch from EDM notch.

h. Position front edge of search unit 1.0 inch from EDM notch as shown in figure 3.

i. Maximize EDM notch response by swiveling search unit and removing excess ultrasonic couplant between search unit and EDM notch.

j. Adjust SWEEP RANGE so EDM notch response is located at 4 on CRT horizontal baseline. See figure 4, CRT 1.

k. Reposition search unit 2.0 inches from EDM notch and maximize response by swiveling search unit and removing excess ultrasonic couplant between search unit and EDM notch.

l. Adjust SWEEP RANGE to 2.0 inch response leading edge at 8 on CRT horizontal baseline.

m. Reposition search unit 1.0 inch from EDM notch and if response leading edge is no longer located at 4, adjust SWEEP DELAY to relocate response at 4. Repeat this process until 1.0 inch response leading edge is located at 4 and 2.0 inch response is located at 8 on CRT horizontal baseline.

n. Position search unit 1.0 inch from EDM notch.

o. Adjust GAIN to bring EDM notch response amplitude to 70-75 percent CRT height.

p. Place transparent tape over filter covering CRT screen.

q. Develop distance-amplitude correction (DAC) curve by marking response peak on tape covering CRT filtering using aircraft marking pencil.

r. Position search unit 1.5 inch and 2.0 inches from EDM notch and mark response peak on tape covering CRT at each location. See figure 4, CRT 2.

s. For 74D110007-1001 reference standard add 14dB GAIN and verify EDM notch response amplitude increases. For 74SB2462 reference standard, add no GAIN.

#### 14. Inspection Procedure.

### WARNING

Ultrasonic couplant may cause eye irritation. Avoid contact with eyes. Wash thoroughly after handling.

- a. Apply ultrasonic couplant to inspection area.

### NOTE

Only light film of ultrasonic couplant is required. Excess couplant may cause false indications.

b. Position search unit on inspection area approximately 2 inches from lower radius of trunnion post.

c. Scan toward radius so sound beam is directed perpendicular to length of typical crack. See figure 5.

d. Swivel search unit right and left within included angle of 40° during scanning.

e. Scan until bulkhead interferes with search unit movement or curvature of inspection surface does not allow correct coupling with search unit.

f. Index 0.10 inch after each scan until all of inspection area has been covered.

g. Mark any response which exceeds DAC curve with aircraft marking pencil. See figure 6.

h. Verify suspected crack response(s) by removing excess ultrasonic couplant and damping response(s).

i. If no crack(s) is found do magnetic particle inspection per paragraph 19.

j. If crack(s) is found have trunnion replaced (A1-F18AC-130-300, WP037 00) or notify depot for rework of parabolic fillet.

k. After rework do magnetic particle inspection per paragraph 19.

#### 15. ULTRASONIC METHOD USING MXU-715/E ULTRASONIC FLAW DETECTOR.

### Support Equipment Required

Part Number or Type Designation	Nomenclature
164AS100-1	Ultrasonic Flaw Detector, MXU-715/E, Magnaflux
57A2271 or EQUIVALENT 57A3055 or EQUIVALENT	Microdot to BNC Connecting Cable 90°, 0.250 X 0.250 Inch, 5 MHZ, Contact Surface Wave Search Unit
74D110007-1001 (74SB2462)	Ultrasonic Reference Standard For Main Landing Gear Lever

### Materials Required

Specification or Part Number	Nomenclature
ULTRAGEL II 020X413 M83953-1 or -2	Ultrasonic Couplant Cleaning Compound Penci, Aircraft Marking
CCCC46TY1CL4 —	Cloth, Cleaning Clear Tape, Transparent Tape, Scotch Tape

### WARNING

Cleaning compound is flammable liquid and vapor. May cause allergic respiratory and skin reaction. May cause eye, skin and respiratory irritation. Keep away from heat, sparks, and flame. Do not breathe dust (vapor, mist, gas). Use only with adequate ventilation. Keep container closed. Avoid contact with eyes, skin and clothing. Wash thoroughly after handling.

16. **Preparation of Part.** Remove inspection penetrant using cleaning cloth moistened with cleaning compound. Allow surface to air dry 15 minutes.

**17. Equipment Setting/Standardization/Setup.**

a. Do general setup procedure per (WP008 07).  
Begin with initial equipment settings per (WP008 07) except as follows:

**NOTE**

Equipment differences may require use of alternate REP. RATE, DAMP., FREQ., GAIN, and HORIZONTAL SWEEP DELAY and LENGTH. Following completion of general setup, initial pulse should be located at 0 on CRT horizontal baseline. See figure 4, CRT 1.

GAIN .....	75 dB
COURSE GAIN .....	7
FINE GAIN .....	5
HORIZONTAL	
SWEEP DELAY	
COURSE .....	5
FINE .....	9.7
HORIZONTAL	
SWEEP LENGTH	
COURSE .....	5
FINE .....	8.4

**WARNING**

Ultrasonic couplant may cause eye irritation. Avoid contact with eyes. Wash thoroughly after handling.

b. Apply ultrasonic couplant to reference standard approximately 1.0 inch from EDM notch.

c. Position front edge of search unit 1.0 inch from EDM notch as shown in figure 3.

d. Maximize EDM notch response by swiveling search unit and removing excess ultrasonic couplant between search unit and EDM notch.

e. Adjust HORIZONTAL SWEEP LENGTH so EDM notch response is located at 4 on CRT horizontal baseline. See figure 7, CRT 1.

f. Reposition Search unit 2.0 inches from EDM notch and maximize response by swiveling search unit and removing excess ultrasonic couplant between search unit and EDM notch.

g. Adjust HORIZONTAL SWEEP LENGTH to 2.0 inch response leading edge at 8 on CRT horizontal baseline.

h. Reposition search unit 1.0 inch from EDM notch and if response leading edge is no longer located at 4, adjust HORIZONTAL SWEEP DELAY to relocate response at 4. Repeat this process until 1.0 inch response leading edge is located at 4 and 2.0 inch response is located at 8 on CRT horizontal baseline.

i. Position search unit 1.0 inch from EDM notch. Adjust GAIN to bring EDM notch response amplitude to 70-75 percent CRT height.

j. Place transparent tape over filter covering CRT screen.

k. Develop distance-amplitude correction (DAC) curve by marking response peak on tape covering CRT filtering using aircraft marking pencil.

l. Position search unit 1.5 inch and 2.0 inches from EDM notch.

m. Mark response peak on tape covering CRT at each location. See figure 7, CRT 2.

n. For 74D110007-1001 reference standard add 14dB GAIN and verify EDM notch response amplitude increases. For 74SB2462 reference standard, add no GAIN.

**18. Inspection Procedure.****WARNING**

Ultrasonic couplant may cause eye irritation. Avoid contact with eyes. Wash thoroughly after handling.

a. Apply ultrasonic couplant to inspection area.

**NOTE**

Only light film of ultrasonic couplant is required. Excess ultrasonic couplant may cause false indications.

b. Position search unit on inspection area approximately 2 inches from lower radius of trunnion post.



c. Scan toward radius so sound beam is directed perpendicular to length of typical crack. See figure 5.

d. Swivel search unit right and left within included angle of 40° during scanning.

e. Scan until bulkhead interferes with search unit movement or curvature of inspection surface does not allow correct coupling with search unit.

f. Index 0.10 inch after each scan until all of inspection area has been covered.

g. Mark any response which exceeds DAC curve with aircraft marking pencil. See figure 8.

h. Verify suspected crack response(s) by removing excess ultrasonic couplant and damping response(s).

i. If no crack(s) is found do magnetic particle inspection per paragraph 19.

j. If crack(s) is found have trunnion replaced (A1-F18AC-130-300, WP037 00) or notify depot for rework of parabolic fillet.

19. **MAGNETIC PARTICLE INSPECTION.** See figure 9. Do Magnetic Particle Inspection (WP006 00 and NAVAIR 01-1A-16), Chapter 2 except as below:

### Support Equipment Required

Part Number or Type Designation	Nomenclature
DA200	Magnetic Inspection Probe
M-16	Black Light
—	14 X Magnifier

### Materials Required

Specification or Part Number	Nomenclature
14AM	Magnetic Inspection Compound
AA883TYPE1-0-500IN	Tape, Pressure Sensitive
CCCC46TY1CL4 020X413	Cloth, Cleaning Cleaning Compound

### WARNING

Cleaning compound is flammable liquid and vapor. May cause allergic respiratory and skin reaction. May cause eye, skin and respiratory irritation. Keep away from heat, sparks, and flame. Do not breathe dust (vapor, mist, gas). Use only with adequate ventilation. Keep container closed. Avoid contact with eyes, skin and clothing. Wash thoroughly after handling.

20. **Preparation of Part.** Clean inspection area(s) of any contamination and foreign material using cleaning cloth moistened with cleaning compound. Allow surface to air dry 15 minutes.

21. **Equipment Settings/Standardization/Setup.** Do Equipment Settings/ Standardization/Setup for Longitudinal Magnetization Using Electromagnetic Probe (WP006 00) except; set AC/DC switch to AC.

22. **Inspection Procedure.** Do Inspection Procedure For True Continuous Longitudinal Magnetization Using Electromagnetic Probe (WP006 00) except as below:

a. Mask bearing surfaces or other areas outside inspection area using pressure sensitive tape to protect from inspection material.

b. Darkened area for part inspection.

c. Position magnetic inspection probe (probe) on spindle at inspection position 1.

## WARNING

Magnetic inspection compound may cause eye and skin irritation. Avoid contact with eyes, skin and clothing. Wash thoroughly after handling.

## CAUTION

Probe method of magnetization shall be used. Pass no current through parts to avoid possible arc burns.

Avoid overheating of probe. Do not exceed duty cycle. Duty cycle is 2 minutes on, 2 minutes off.

d. Apply magnetic inspection compound to inspection area and immediately press ON, to magnetize part.

e. Current shall remain on while inspecting.

f. Using black light and magnifier, inspect for cracks. Inspection areas and typical cracks are shown in figure 9.

g. Mark location of any crack indication with an aircraft marking pencil and record.

h. Reposition probe for inspection position 2. Repeat steps d through g.

i. Demagnetize. Do Demagnetization (WP006 00).

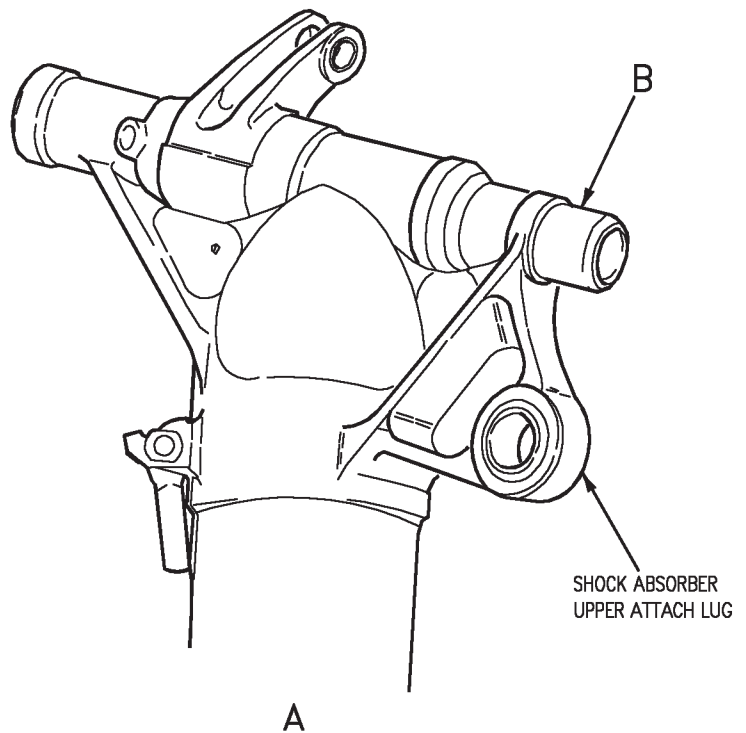
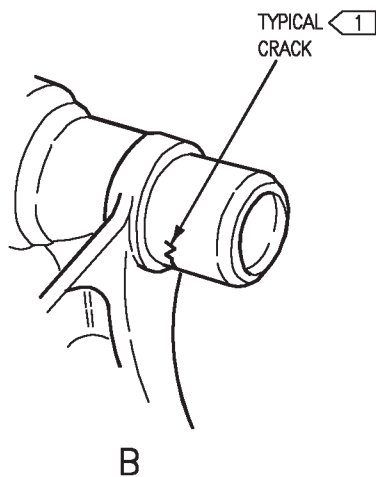
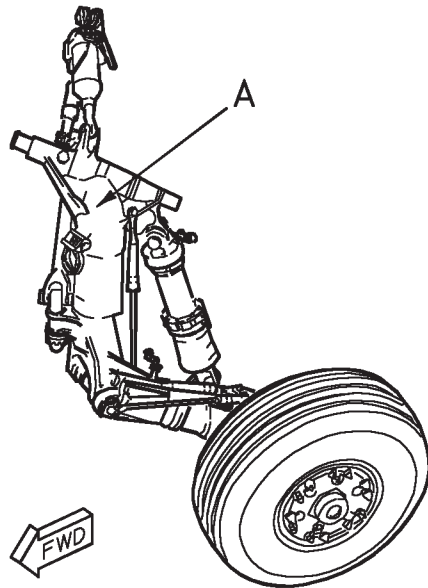
## 23. POST INSPECTION CLEANING AND CORROSION CONTROL.

## WARNING

Cleaning compound is flammable liquid and vapor. May cause allergic respiratory and skin reaction. May cause eye, skin and respiratory irritation. Keep away from heat, sparks, and flame. Do not breathe dust (vapor, mist, gas). Use only with adequate ventilation. Keep container closed. Avoid contact with eyes, skin and clothing. Wash thoroughly after handling.

a. Clean magnetic inspection compound from inspection area using cleaning cloth moistened with cleaning compound. Allow surface to air dry 15 minutes before application of finish system.

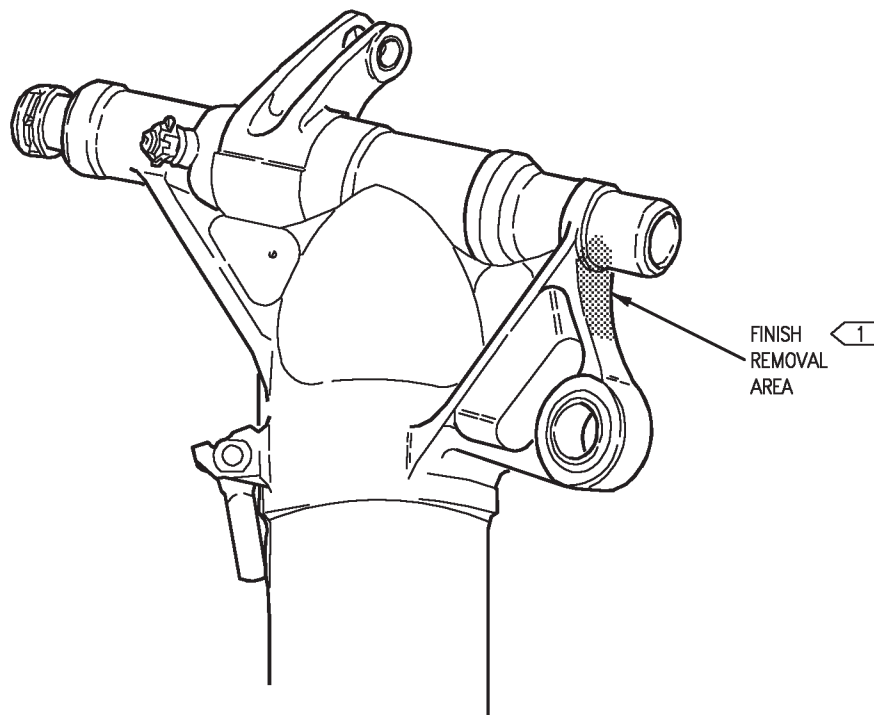
b. Have finish system reapplied (A1-F18AC-SRM-500, WP012 00).



## LEGEND

1 CRACK EXTENDS AROUND LOWER PART OF TRUNNION POST TO OPPOSITE SIDE

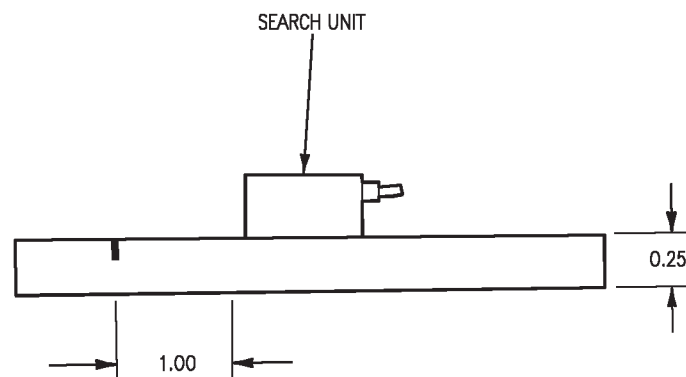
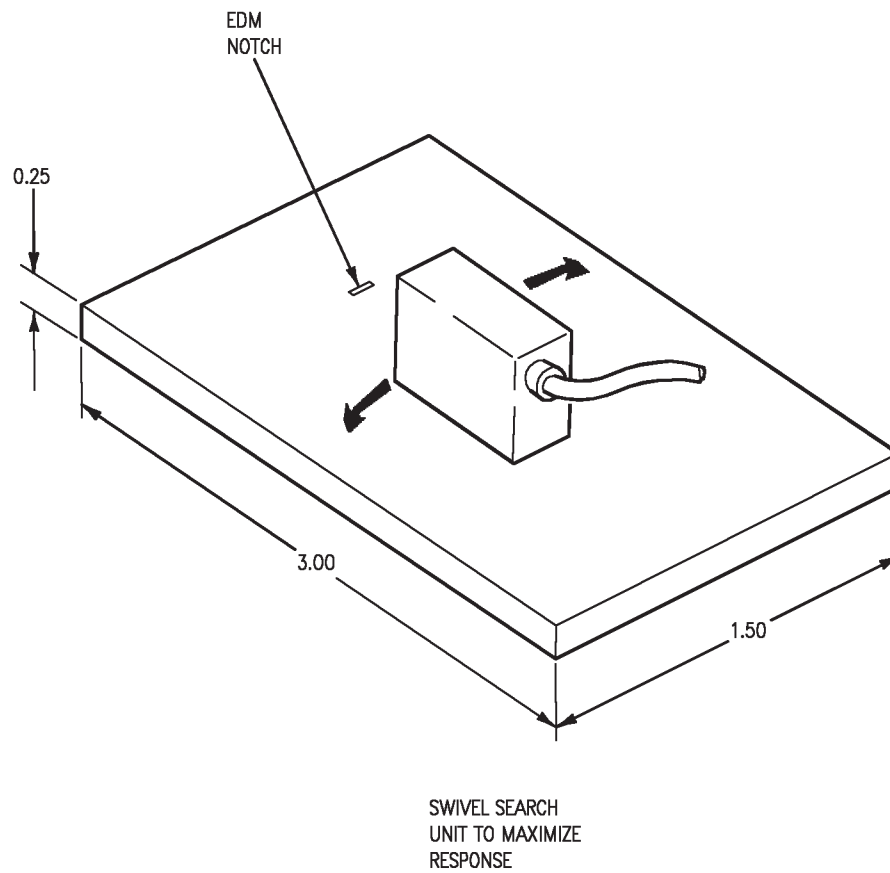
Figure 1. MLG Trunnion Inspection Area



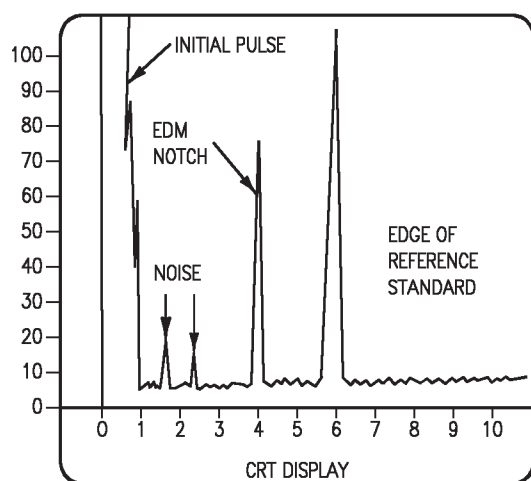
### LEGEND

1 MASK ALL NEARBY AREAS

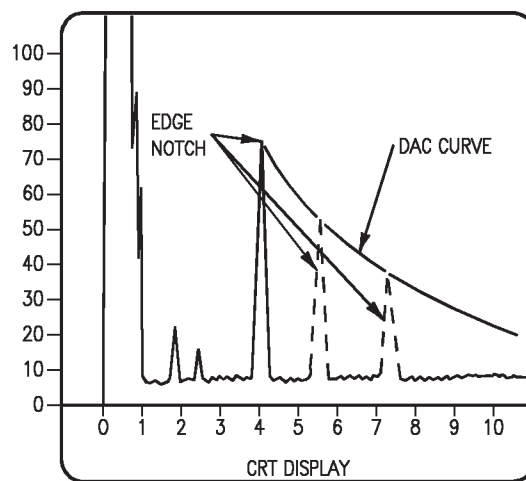
**Figure 2. Finish Removal for Inspection**



**Figure 3. Ultrasonic Reference Standard**

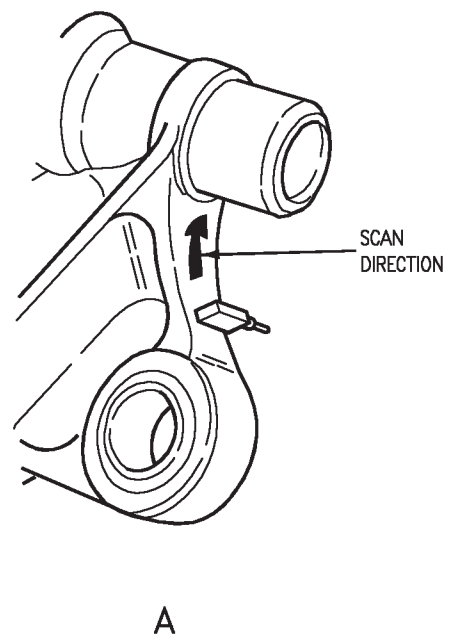
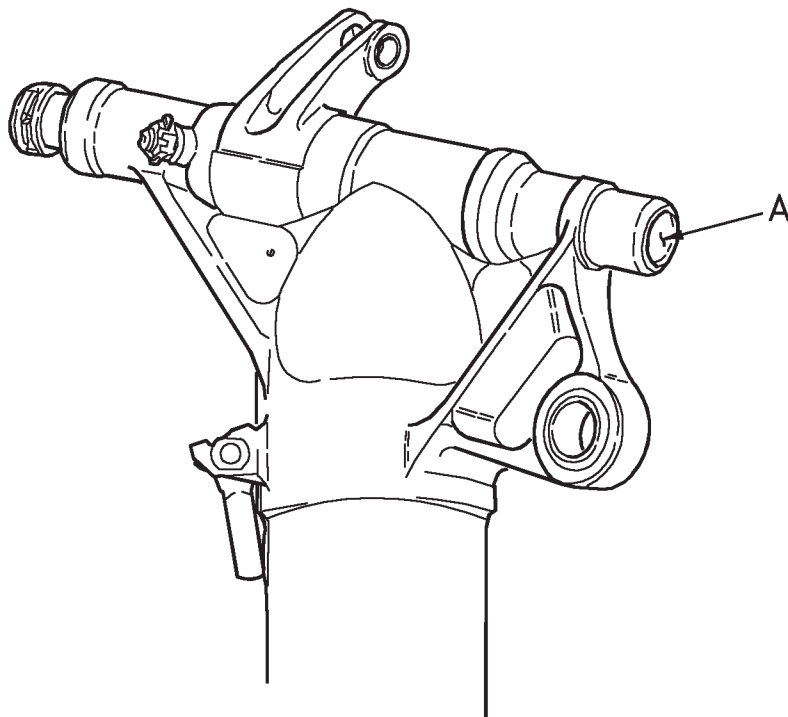


CRT 1

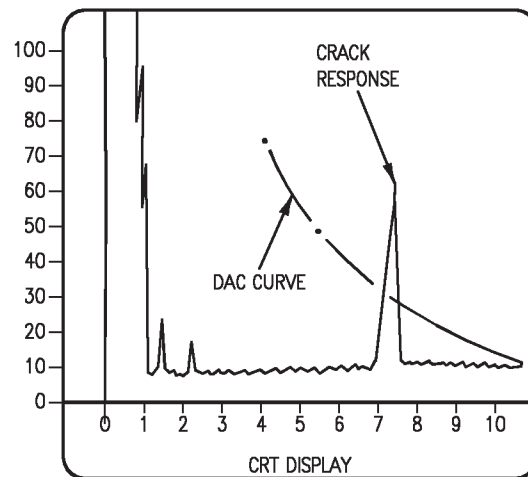


CRT 2

Figure 4. Ultrasonic Standardization Using C-398 Ultrasonic Flaw Detector



**Figure 5. Ultrasonic Scan**



**Figure 6. Rejectable Crack Response Using C-398 Ultrasonic Flaw Detector**



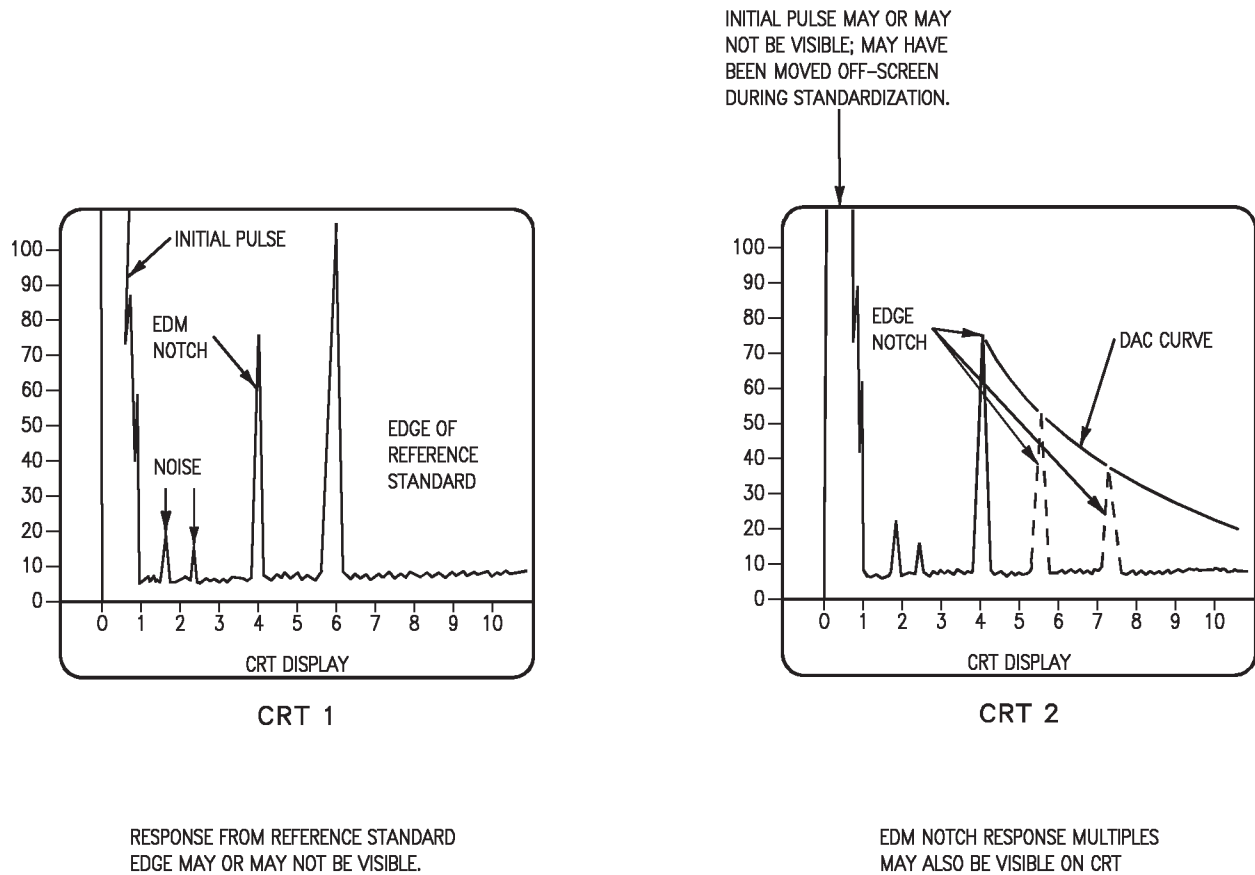


Figure 7. Ultrasonic Standardization Using MXU-715/E Ultrasonic Flaw Detector

INITIAL PULSE MAY OR MAY NOT  
BE VISIBLE. MAY HAVE BEEN MOVED  
OFF-SCREEN DURING STANDARDIZATION.

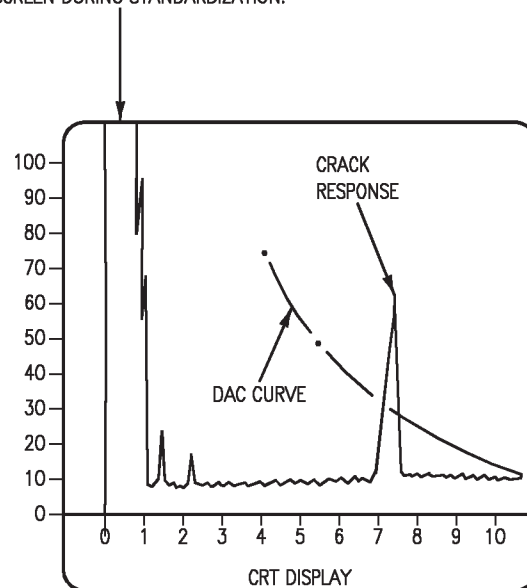
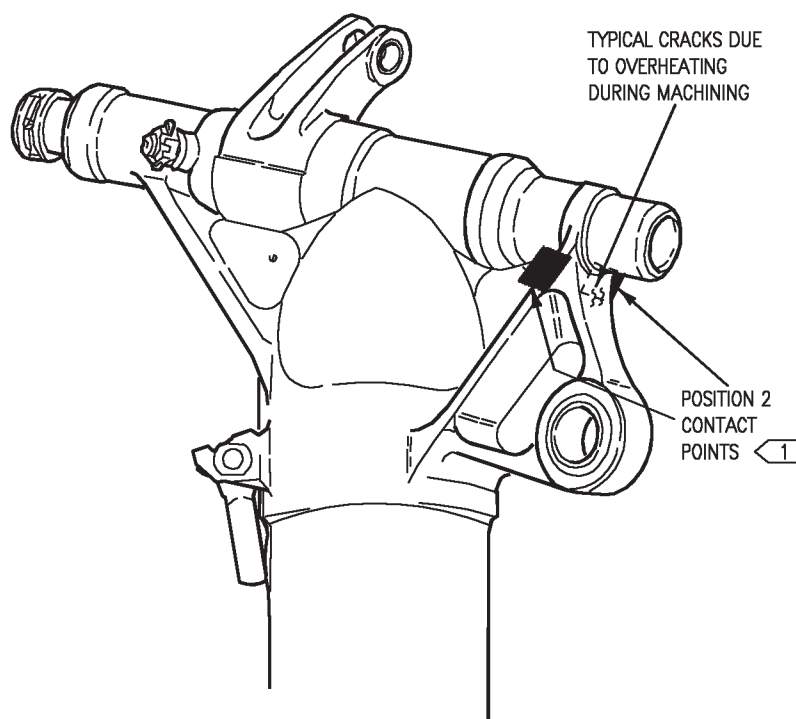
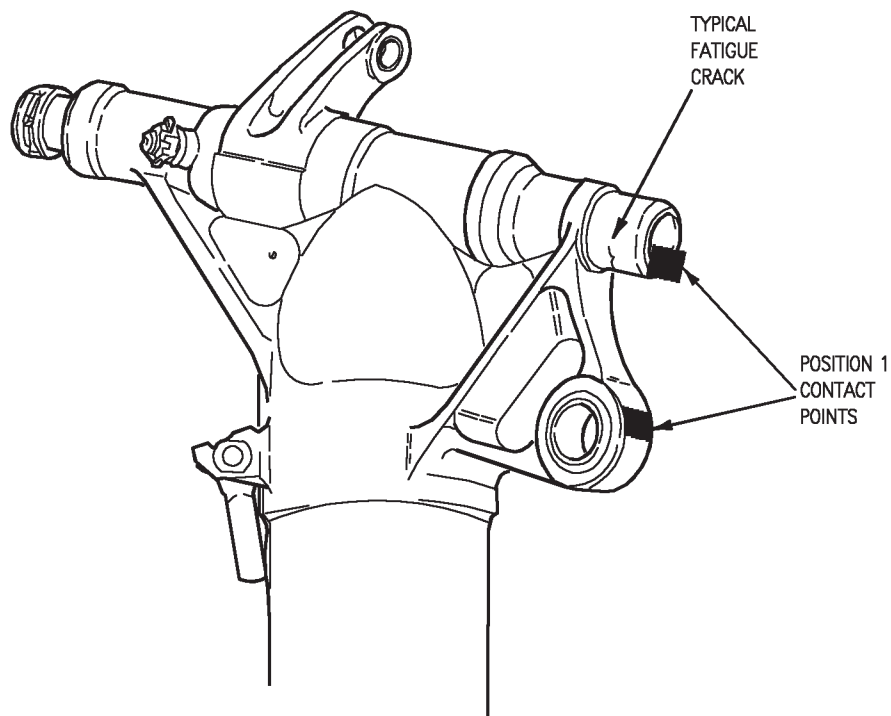


Figure 8. Rejectable Crack Response Using MXU-715/E Ultrasonic Flaw Detector



## LEGEND

- 1 SECOND CONTACT POINT IS LOCATED ON OPPOSITE SIDE AT SAME POSITION AS ONE SHOWN

Figure 9. Magnetic Particle Inspection



## INTERMEDIATE MAINTENANCE

## NONDESTRUCTIVE INSPECTION

## MAIN LANDING GEAR SIDE BRACE ATTACH FITTING

## CRACKS

## PART NO. 74A324573-1005 THROUGH 1008

## Reference Material

Naval Aviation Maintenance Program .....	OPNAVINST 4790.2
Landing Gear and Related Systems.....	A1-F18AC-130-300
MLG Side Brace Assembly .....	WP038 01
Nondestructive Inspection.....	A1-F18AC-SRM-300
Penetrant Method.....	WP004 00
Aircraft Corrosion Control.....	A1-F18AC-SRM-500
Stripping.....	WP007 00
Finish System .....	WP012 00
Landing Gear, Arresting Hook, and Launch Bar, Finish System and Markings .....	WP042 00
Line Maintenance Procedures.....	A1-F18AC-LMM-000

## Alphabetical Index

Subject	Page No.
Main Landing Gear Side Brace Attach Fitting.....	2
Defects .....	2
Post Inspection Cleaning and Corrosion Control.....	3
Primary Inspection Method .....	2
System Securing.....	3

## Record of Applicable Technical Directives

Type/ Number	Date	Title and ECP No.	Date Incorp.	Remarks
F/A-18 AFB 123 Amend 1	19 June 87	Inspection of Main Landing Gear (MLG) Side Brace Attach Fitting (Purpose: To Amend Ref A MLG Side Brace Assembly Removal Procedure and Add Additional Cautionary Statement)	1 Aug 88	-

## 1. MAIN LANDING GEAR SIDE BRACE ATTACH FITTING.

2. Main landing gear side brace attach fitting (attach fitting) is titanium forging. Finish system is epoxy primer and polyurethane enamel.

3. **DEFECTS.** Inspect attach fitting for cracks, see figure 1.

4. **PRIMARY INSPECTION METHOD.** Primary inspection method is fluorescent penetrant.

5. **Personnel Qualifications.** Personnel doing this nondestructive inspection should be qualified and certified to do liquid penetrant inspections per OPNAVINST 4790.2 SERIES, NDI Technicians, NEC 7225/MOS 6044..

6. **Preparation of Aircraft.** Have aircraft jacked. (A1-F18AC-LMM-000).

7. **Access.** Have attach fittings removed, left and right (A1-F18AC-130-300, WP038 01).

## Support Equipment Required

### NOTE

Alternate item type designations or part numbers are listed in parentheses.

Part Number or Type Designation	Nomenclature
XMA101 (ZA43) (TT10)	Portable Fluorescent Penetrant Inspection Kit
M-16	Black Light
J-221	Ultraviolet Meter
—	14× Magnifier

## Materials Required

### NOTE

Alternate item Specification or part numbers are shown indented.

Specification or Part Number	Nomenclature
CCC-C-440, TYPE 1, CLASS 1	Cheesecloth

## Materials Required (Continued)

### NOTE

Alternate item Specification or part numbers are shown indented.

Specification or Part Number	Nomenclature
H-B-643, TYPE 2, CLASS 1, SIZE 1	Acid Swab Brush
MIL-T-23397, TYPE 2 MS36070	Pressure Sensitive Tape Washing Bottle
P-D-680, TYPE 2 D 1153	Dry Cleaning Solvent Methyl Isobutyl Ke- tone
MIL-P-83953, TYPE 1, CLASS A or B, RED or BLACK	Aircraft Marking Pencil

## 8. Preparation of Part.

a. Have finish system removed from inspection areas (A1-F18AC-SRM-500, WP007 00).

### WARNING

Dry cleaning solvent and methyl isobutyl ketone are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

b. Clean inspection areas with solvent moistened cloth to make sure inspection areas are free of contamination or foreign material.

## 9. Inspection Procedure.

a. Do type 1, method C fluorescent penetrant inspection (WP004 00).

b. After removing penetrant, spray thin film of developer on inspection areas.

c. Use black light and 14× magnifier to view inspection areas for cracks.

d. Evaluate indications, mark location of any defect with aircraft marking pencil and record.

e. If no crack exist refer to paragraph 10.

f. If crack less than 0.090 exist contact depot field team and refer to paragraph 10 when notified.

g. If crack larger than 0.090 exist contact depot engineering for disposition.

## **10. POST INSPECTION CLEANING AND CORROSION CONTROL.**

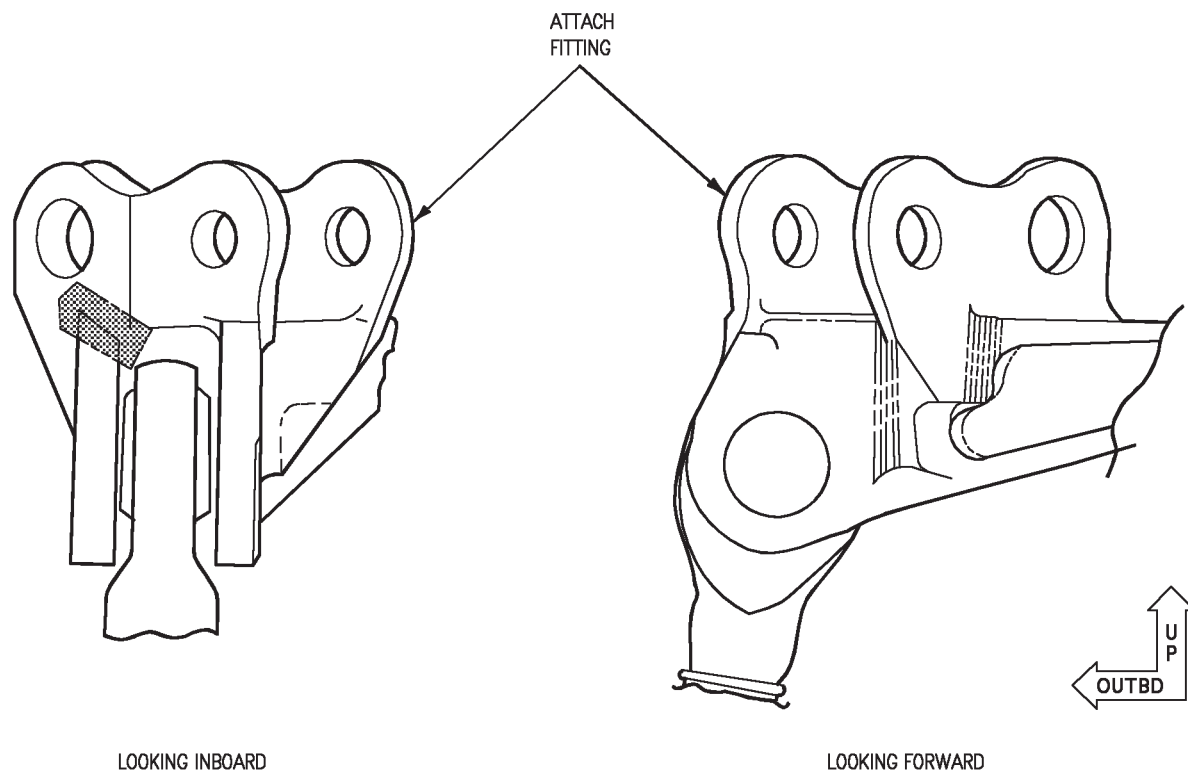
a. Clean inspection materials from inspection areas with solvent moistened cloth.

b. Have inspection areas refinished  
(A1-F18AC-SRM-500, WP012 00 and WP042 00).

## **11. SYSTEM SECURING.**

a. Have attach fittings reinstalled  
(A1-F18AC-130-300, WP038 01).

b. Have aircraft removed from jacks  
(A1-F18AC-LMM-000).



LEFT SHOWN  
RIGHT OPPOSITE

## LEGEND

 INSPECTION AREA  
BOTH SIDES AND  
TOP OF FWD LUG

**Figure 1. Inspection Area Location**



## INTERMEDIATE MAINTENANCE

## NONDESTRUCTIVE INSPECTION

## MAIN LANDING GEAR AXLE LEVER WALL THICKNESS MEASUREMENT

PART NO. 74A410506

## Reference Material

Naval Aviation Maintenance Program .....	OPNAVINST 4790.2
Landing Gear and Related Systems.....	A1-F18AC-130-300
MLG Axle Lever Assembly and MLG Lever Swing Joint Support .....	WP040 00
Plane Captain's Manual.....	A1-F18AC-LMM-000
Aircraft Corrosion Control.....	A1-F18AC-SRM-500
Removal and Cleanup of Corrosion from Main Landing Gear Axle Lever Assembly.....	WP005 05

## Alphabetical Index

Subject	Page No.
Main Landing Gear Axle Lever Assembly .....	1
Defects .....	1
General Information .....	1
Inspection Procedure .....	3
Primary Inspection Method .....	1

## Record of Applicable Technical Directives

Type/ Number	Date	Title and ECP No.	Date Incorp.	Remarks
F/A-18AYC-834 Amend 3	2 May 00	Inspection of Main Landing Gear (MLG) Axle Lever Assembly	1 Feb 02	-

## 1. MAIN LANDING GEAR AXLE LEVER ASSEMBLY.

2. Main landing gear axle lever assembly (lever assembly) is machined 300M steel forging. The external surfaces are IVD aluminum coated or cadmium plated. The finish system is epoxy primer and enamel topcoat. Internal surface is cadmium plated and coated with epoxy primer.

3. **GENERAL INFORMATION.** The inspection method below was developed to support corrosion removal procedures for main landing gear axle lever,

P/N 74A410506-1009/1010/1011/1012, as defined in (A1-F18AC-SRM-500, WP005 05). For levers with P/N 74A410506-1005/1006, contact FST for disposition.

4. **DEFECTS.** Inspect lever assembly wall thickness in areas A, B, and C as shown in figure 1.

5. **PRIMARY INSPECTION METHOD.** Primary inspection method is pulse-echo ultrasonic thickness gauging.

6. **Personnel Qualifications.** Personnel doing this nondestructive inspection shall be qualified and certified to do pulse-echo ultrasonic per OPNAVINST 4790.2 SERIES, NDI Technicians, NEC 7225/MOS 6044.

7. **Preparation of Aircraft.** Have aircraft prepared for jacking. (A1-F18AC-LMM-000).

8. **Access.** No special access required.

### Support Equipment Required

Part Number or Type Designation	Nomenclature
USN-52	Ultrasonic Flaw Detector
PD-238	Ultrasonic Transducer Group
2214E	Step Wedge, 1018 Steel

### Materials Required

Specification or Part Number	Nomenclature
P-D-680 TYPE 2 (CAGE 81348)	Dry Cleaning Solvent
ULTRAGEL 11 (CAGE 57869)	Ultrasonic Couplant

### 9. Preparation of Part.

#### WARNING

Dry cleaning solvent and methyl isobutyl ketone are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

#### NOTE

Paint and primer must be removed and the surface must be smooth before initial thickness measurement (A1-F18AC-SRM-500, WP005 05). Hand sanding with 320 grit or finer abrasive to smooth the surface before initial thickness measurement is acceptable. Sanding is only acceptable in areas that are to be blended and subsequently refinished.

a. Clean inspection areas with solvent moistened cloth to make sure inspection areas are free of contamination or foreign material.

b. Remove brake hydraulic tube assemblies if interference with inspection area is obvious (A1-F18AC-130-300, WP040 00).

c. Unclamp electrical cable assemblies and tied back, as required (A1-F18AC-130-300, WP040 00).

### 10. Equipment Settings/Standardization/Setup.

#### WARNING

Make sure safety precautions have been met for electrical, static, grounding when using ultrasonic equipment near aircraft fuel cells, oxygen systems, electrical systems, and stores (A1-F18AC-PCM-000).

a. Clean the surfaces of the transducer and delay line.

b. Apply clean couplant and assemble the delay line with the transducer.

c. Rotate the delay line while tightening the retaining collar to squeeze out all excess couplant.

d. Connect the transducer and cable to the ultrasonic flaw detector.

e. Initial settings are as below:

#### NOTE

Menu items not listed are either inspector preference or are not in effect.

Asterisks (\*) settings are to be adjusted by the inspector as required.

In the **POS HALF** display mode, one spike of the back surface reflection from any step of the calibration block should be three or more times the height of the surrounding spikes. If this is not the case, switch to **NEG HALF**. Use the mode that presents the most clearly distinguished spike. If neither mode displays a single spike that is at least double the height of the adjacent spikes, the transducer is inadequately damped and shall not be used for this procedure.

#### UPPER LEVEL MENUS

GAIN*	50.0 dB
RANGE	0.400 inch
mtl vel*	0.2338/Hs
DELAY	-0.203 Hs
DAMPING	50 OHM
RECIF	POS HALF
	(See Note)
PULSER	SINGLE
REJECT	0 %
REP-RATE	LOW
a-THRESH	40 %
a-START	0.075 inch
a-WIDTH	0.300 inch
ZERO*	8.680 Hs
DAC/TCG	OFF

#### LOWER LEVEL MENUS

GRATICULE	ON
AMPLITUDE	% SCREEN HT
GATE LOGIC	MEASURE

MEAS UNIT	INCH
ANGLE	OFF
AUTO CAL	OFF
MEASURE	0 TO 1ST
TOF	PEAK

#### NOTE

Allow the ultrasonic flaw detector to warm up for at least 5 minutes before attempting calibration. Instrument drift may be significant relative to the accuracy required from this inspection. Drift was observed with the instrument used to develop this procedure.

f. Couple the transducer to the 0.100 inch step of the calibration standard and adjust **ZERO** as required to get a reading of 0.100 inch on the display.

g. Couple the transducer to the 0.300 inch step and adjust the mtl. vel as required to get 0.300 on the display.

h. Repeat steps f. and g. until precise readings are obtained on both steps. Adjust **GAIN** as required to maintain an echo amplitude of 60 % to 100 % from the step being measured.

i. Couple the transducer to the 0.200 inch step. The display should read within +/- 0.001 inch of 0.200. If it does not, test accuracy of the calibration standard using a micrometer calibrated to +/- 0.001 inch accuracy and use the true step thickness for calibration, or get a different calibration step wedge.

j. Test calibration at 5 minute intervals while taking measurements. Try adjusting only the **ZERO** setting first to correct for drift.

#### 11. INSPECTION PROCEDURE.

#### NOTE

Measurements are to taken after paint removal and after the corrosion blending is finished. Refer to Preparation of Part, this WP.

a. Make the measurement templates using flexible plastic or sheet(s) of paper and measurements shown in figure 1.

## NOTE

The templates use 0.25 inch diameter holes on 0.5 inch X 0.5 inch hole spacing.

- b. Position measurement templates as shown in figure 2.

## NOTE

If the display hunts between two adjacent readings with the probe in good contact with the lever arm so as to produce the lowest obtainable reading, report the lowest value. For example, if the display hunts between 0.248 and 0.249, report 0.248.

The wall thickness dimensions on templates for areas A, B, and C on figure 1 are applicable for main landing gear axle lever, P/N 74A410506-1009/-1010/-1011/-1012 only. For levers with (74A410506-1005/-1006), contact FST.

This procedure approaches the accuracy limit for manual thickness gauging with the available equipment and must be done carefully with a steady hand. The goal is to determine the true thickness with less than +/- 0.001 inch error.

- c. Take a measurement at each point and record.

- d. Compare the recorded measurements for each inspection area with the limits specified in tables 1, 2 or 3.

- e. If readings at any point indicate that the material removal exceeded the specified limits, contact FST.

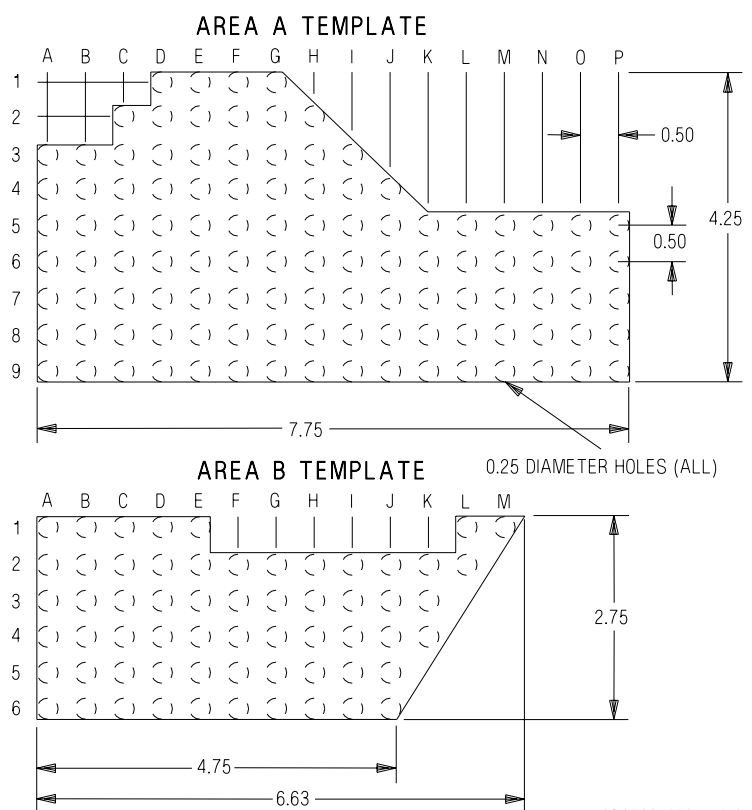
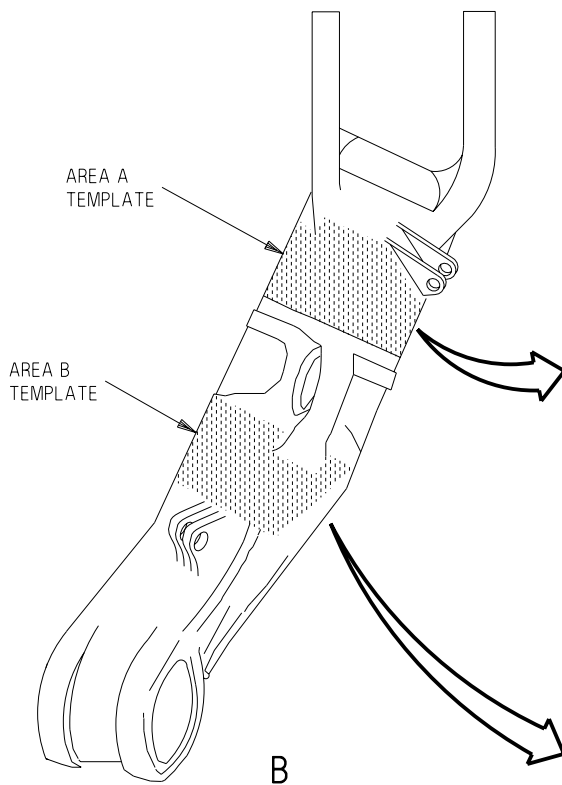
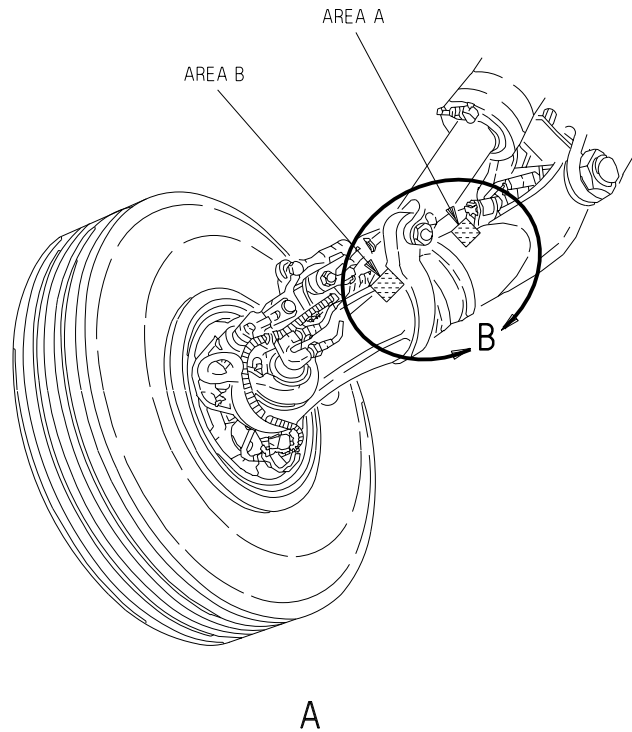
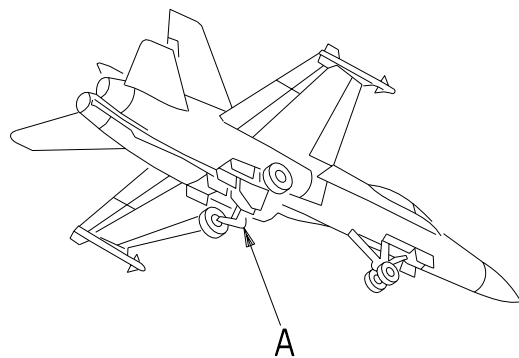
**Table 1. Area A (Applicable for 74A410506-1009 thru -1012 only)**

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1				0.209	0.209	0.209	0.209									
2			0.216	0.216	0.216	0.216	0.216	0.216								
3	0.223	0.223	0.223	0.223	0.223	0.223	0.223	0.223	0.223							
4	0.229	0.229	0.229	0.229	0.229	0.229	0.229	0.229	0.229	0.229						
5	0.236	0.236	0.236	0.236	0.236	0.236	0.236	0.236	0.236	0.236	0.236	0.236	0.236	0.236	0.236	0.236
6	0.243	0.243	0.243	0.243	0.243	0.243	0.243	0.243	0.243	0.243	0.243	0.243	0.243	0.243	0.243	0.243
7	0.245	0.245	0.245	0.245	0.245	0.245	0.245	0.245	0.245	0.245	0.245	0.245	0.245	0.245	0.245	0.245
8	0.245	0.245	0.245	0.245	0.245	0.245	0.245	0.245	0.245	0.245	0.245	0.245	0.245	0.245	0.245	0.245
9	0.245	0.245	0.245	0.245	0.245	0.245	0.245	0.245	0.245	0.245	0.245	0.245	0.245	0.245	0.245	0.245

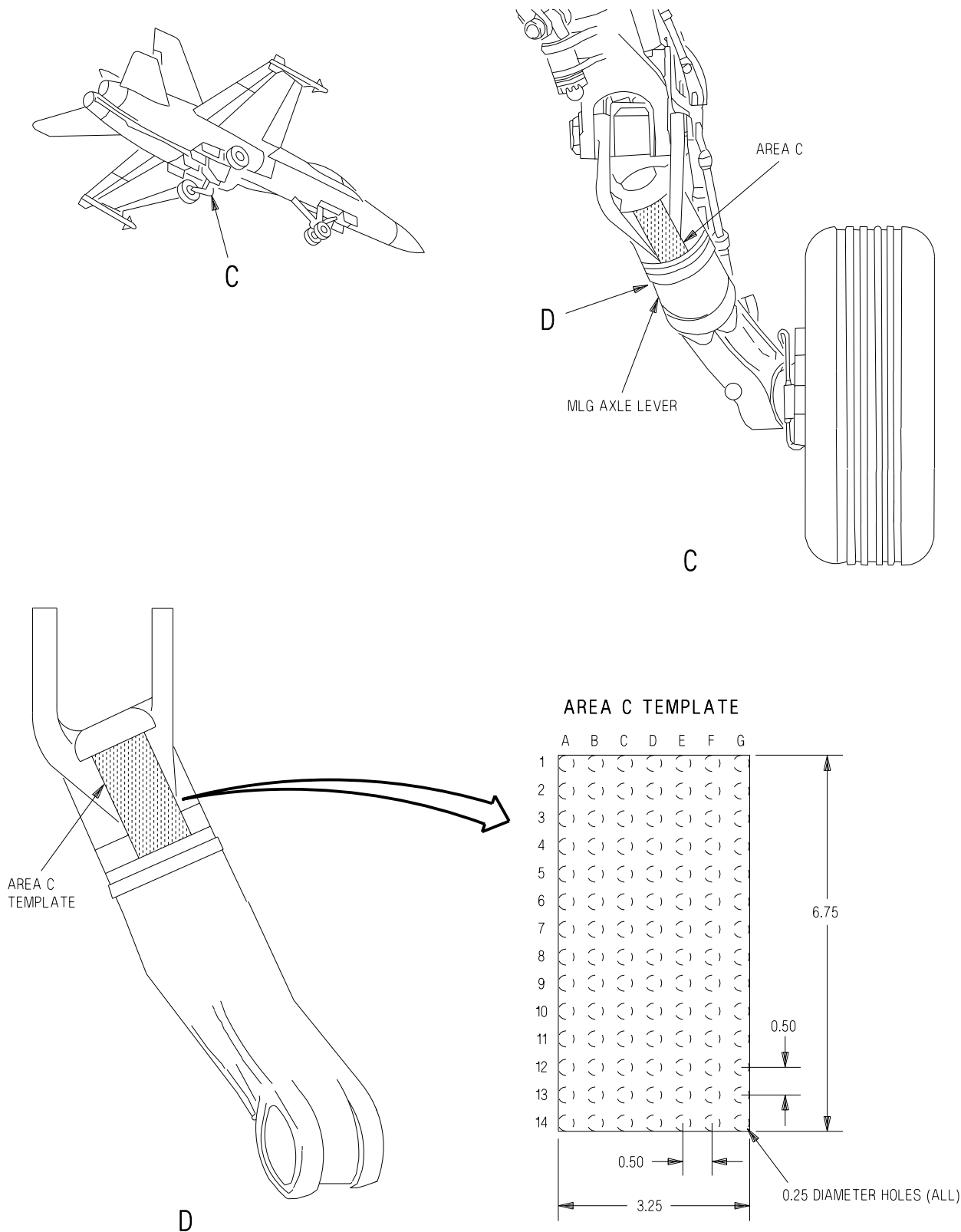
**Table 2. Area B (Applicable for 74A410506-1009 thru -1012 only)**

	A	B	C	D	E	F	G	H	J	K	L	M	N
1	0.442	0.454	0.444	0.418	0.413							0.419	N/A
2	0.461	0.400	0.384	0.385	0.387	0.388	0.390	0.391	0.393	0.394	0.396	0.354	
3	0.372	0.368	0.369	0.371	0.372	0.374	0.375	0.377	0.378	0.380	0.381		
4	0.365	0.354	0.355	0.356	0.358	0.359	0.361	0.362	0.364	0.365	N/A		
5	N/A	N/A	0.383	0.365	0.361	0.360	0.359	0.358	0.356	0.348			
6	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A			



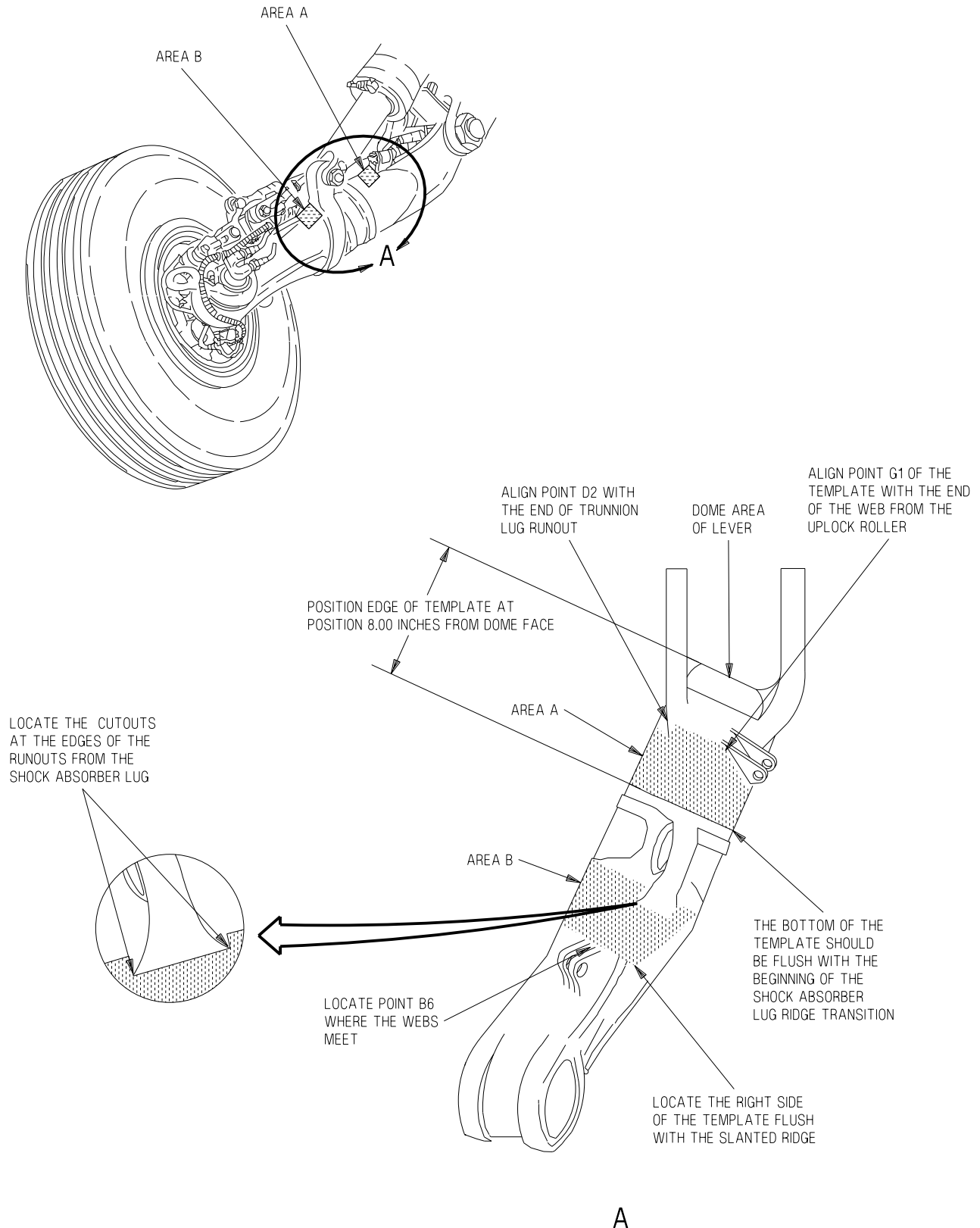


**Figure 1. Main Landing Gear Lever Assembly Templates (Sheet 1)**

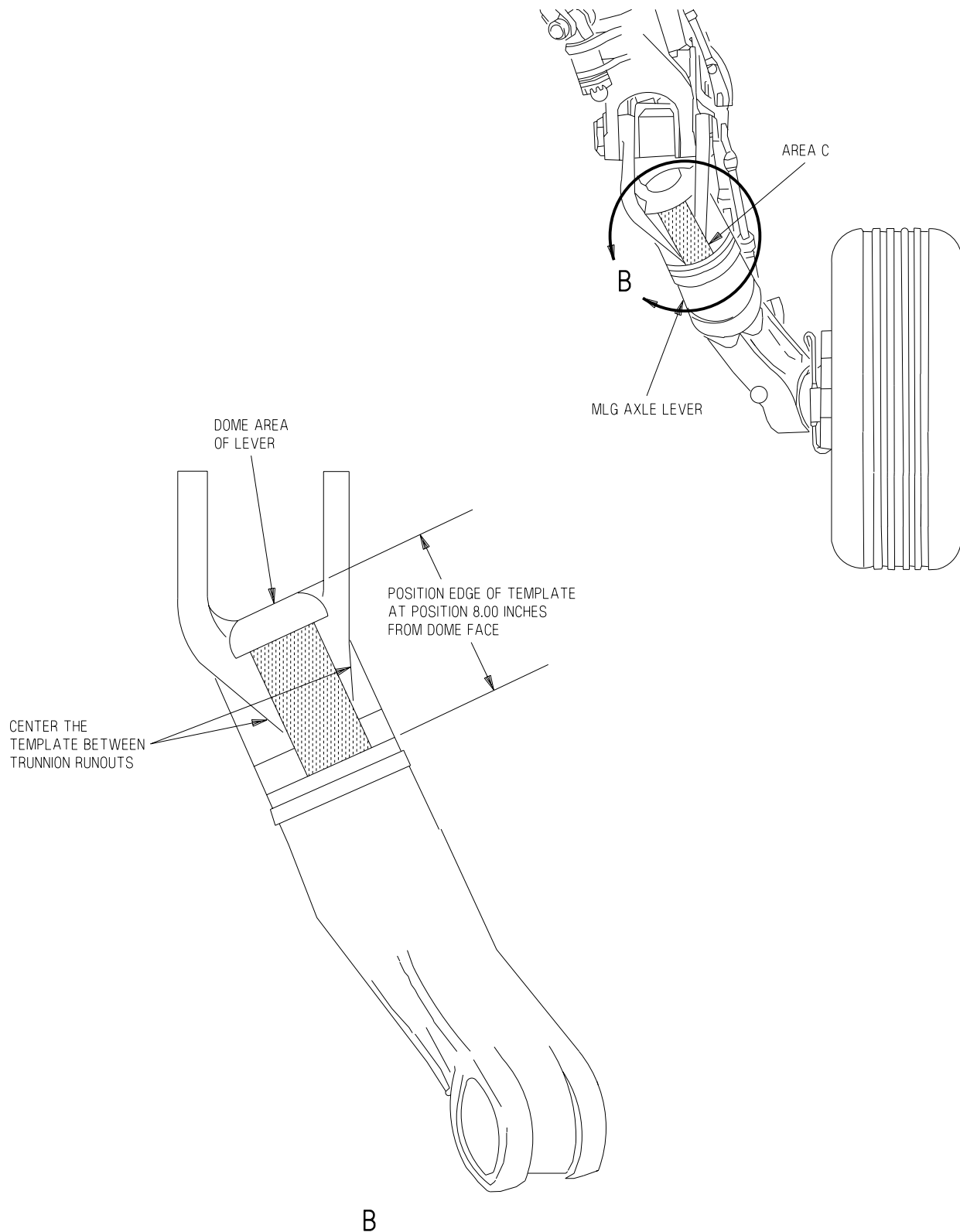


**Figure 1. Main Landing Gear Lever Assembly Templates (Sheet 2)**





**Figure 2. Main Landing Gear Lever Assembly Template Placement (Sheet 1)**



**Figure 2. Main Landing Gear Lever Assembly Template Placement (Sheet 2)**

## IDENTIFICATION

THE MLG AXLE LEVER MUST BE IDENTIFIED USING THE FORGING PART NUMBER.

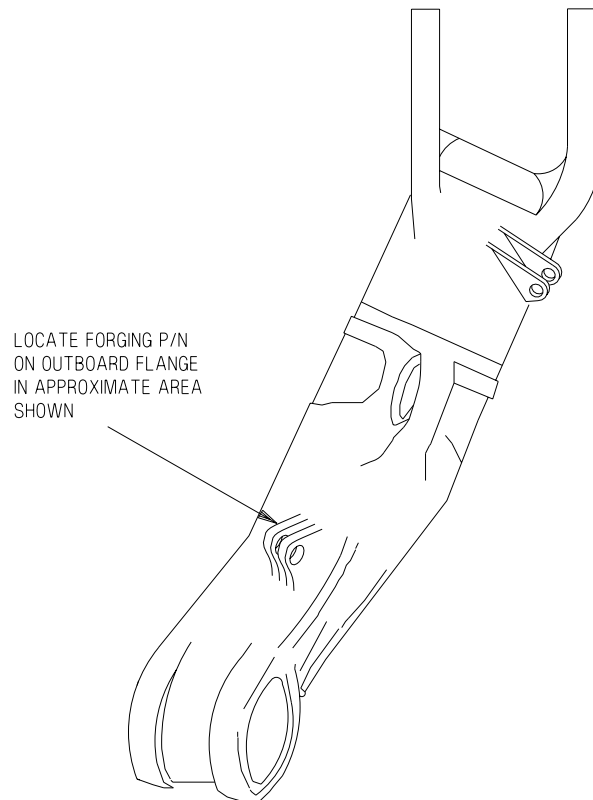
THE TABLE BELOW CONVERTS THE FORGING PART NUMBER TO MLG AXLE LEVER PART NUMBER.

THE FORGING PART NUMBER IS LOCATED ON THE MLG AXLE LEVER ON THE OUTBOARD FLANGE OF THE LOWER AFT ATTACHMENT FOR THE MLG PLANING LINKS.

BELOW SHOWS THE APPROXIMATE LOCATION OF THE FORGING PART NUMBER.

## MLG AXLE LEVER

PART NUMBER	FORGING PART NUMBER
74A410506-1005	74A410506-2009
74A410506-1006	74A410506-2010
74A410506-1009	74A410506-2011
74A410506-1010	74A410506-2012
74A410506-1011	74A410506-2015
74A410506-1012	74A410506-2016



**Figure 3. MLG Axle Lever Assembly Identification**



## INTERMEDIATE MAINTENANCE

## NONDESTRUCTIVE INSPECTION

## ARRESTING HOOK SUPPORT

## FATIGUE CRACKS

## PART NO. 74A332520

## Reference Material

Naval Aviation Maintenance Program .....	OPNAVINST 4790.2
Structure Repair, Aft Fuselage .....	A1-F18AC-SRM-240
Arresting Hook Support and Fairing .....	WP006 00
Aircraft Corrosion Control .....	A1-F18AC-SRM-500
Stripping .....	WP007 00
Finish System .....	WP012 00
Structure Repair, General Information .....	A1-F18AC-SRM-200
Fasteners .....	WP004 06
Nondestructive Inspection .....	A1-F18AC-SRM-300
Penetrant Method .....	WP004 00
Plane Captain Manual .....	A1-F18AC-PCM-000

## Alphabetical Index

Subject	Page No.
Arresting Hook Support .....	1
Defects .....	1
Eddy Current Method .....	2
Penetrant Method .....	2
Post Inspection Cleaning and Corrosion Control .....	5
Primary Inspection Methods .....	1
System Securing .....	5

## Record of Applicable Technical Directives

None

1. **ARRESTING HOOK SUPPORT.**

2. Arresting hook support (support) is made from 6AL-4V titanium forging. Surface finish is epoxy primer and polyurethane coatings.

3. **DEFECTS.** Inspect support for fatigue cracks, see figure 1.

4. **PRIMARY INSPECTION METHODS.** Primary inspection methods are fluorescent penetrant and eddy current.

5. **Personnel Qualifications.** Personnel doing this nondestructive inspection should be qualified and certified to do liquid penetrant and eddy current inspections per OPNAVINST 4790.2 SERIES, NDI Technicians, NEC 7225/MOS 6044..

**6. PENETRANT METHOD.**

**7. Preparation of Aircraft.** No special preparation required.

**8. Access.** Have support fairing removed (A1-F18AC-SRM-240, WP006 00).

**Support Equipment Required****NOTE**

Alternate item type designations or parts numbers are listed in parentheses.

Part Number or Type Designation	Nomenclature
ZA43 (TT10) (XMA101)	Portable Fluorescent Penetrant Inspection Kit
M-16 J-221 —	Black Light Ultraviolet Meter 14 X Magnifier

**Materials Required****NOTE**

Alternate item specification or part numbers are shown indented.

Specification or Part Number	Nomenclature
P-D-680, TYPE 2 D 1153	Dry Cleaning Solvent Methyl Isobutyl Ketone
A-A-883, TYPE 1	Pressure Sensitive Tape, Masking Tape
MIL-P-83953-2, TYPE 1, CLASS A or B, RED or BLACK	Aircraft Marking Pencil
MIL-C-87962, TYPE I	Cleaning Cloth

**9. Preparation of Part.**

a. Have finish system removed from penetrant inspection areas of support, see figure 1 and (A1-F18AC-SRM-500, WP007 00).

**WARNING**

Dry cleaning solvent and methyl Isobutyl ketone are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

b. Clean inspection areas with solvent moistened cloth to make sure inspection areas are free of contamination or foreign material.

**10. Inspection Procedure.**

a. Do type I, method C fluorescent penetrant inspection (WP004 00).

b. After removing excess penetrant, spray thin film of developer on inspection areas.

c. Use black light and 14 X magnifier to view inspection areas for cracks.

d. Evaluate indications, mark location of any defect with aircraft marking pencil and record.

**11. EDDY CURRENT METHOD.**

**12. Preparation of Aircraft.** No special preparation required.

**13. Access.** Have fasteners 7 through 10 removed from both sides of support, see figure 1 and (A1-F18AC-SRM-200, WP004 06).

**Support Equipment Required****NOTE**

Alternate type designation or part numbers are listed in parentheses.

Part Number or Type Designation	Nomenclature
NDT 15 (NDT 18)	Eddy Current Tester Nortec or Equivalent
MC-111EY 74D110201-1001	Connector Eddy Current Reference Standard Set

Support Equipment Required  
(Continued)

NOTE

Alternate type designation or part numbers are listed in parentheses.

Part Number or Type Designation	Nomenclature
57A2271	Microdot to BNC Connecting Cable
HCF-5/16-2M	Probe

Materials Required

NOTE

Alternate item specifications or part numbers are shown indented.

Specification or Part Number	Nomenclature
P-D-680, TYPE 2 D 1153	Dry Cleaning Solvent Methyl Isobutyl Ke- tone
MIL-C-87962, TYPE 1	Cleaning Cloth

WARNING

Dry cleaning solvent and methyl isobutyl ketone are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

14. **Preparation of Part.** Clean fastener holes with solvent moistened cloth to make sure inspection area is free of contamination or foreign material.

15. **Equipment Settings/Standardization/Setup.** Steps listed below describe setup steps for operating Nortec NDT 15 eddy current phase analysis impedance plane instrument (tester).

WARNING

Make sure safety precautions are met for electrical, static, grounding when using eddy current equipment near aircraft fuel cells, oxygen systems, electrical systems, electronic systems, and stores (A1-F18AC-PCM-000).

- a. Connect MC-111E, Y connector to tester.
- b. Connect 2 microdot to BNC cables to Y connector on tester.
- c. Connect two HCF-5/16-2M probes to connector cables.
- d. Turn tester ON, allow 15 minutes warmup.
- e. Set front face settings;

NOTE

Following tester settings are given as initial guide. Equipment differences may require use of alternate FINE FREQ, GAIN SENSITIVITY, FINE NULL, HORIZONTAL POSITION, and VERTICAL POSITION.

FREQ.....	1 MEG
FINE FREQ .....	2000 KHz
GAIN .....	25 - 35
SENSITIVITY	
HORIZONTAL .....	1
VERTICAL.....	1
STORE .....	ON
FOCUS .....	ADJUST AS RE- QUIRED
INTENSITY .....	ADJUST AS RE- QUIRED
FINE NULL	
X DIRECTION.....	APPROX. MID SCALE
R DIRECTION .....	APPROX. MID SCALE
HORIZONTAL POSI- TION .....	APPROX. MID SCALE

VERTICAL POSI-  
TION..... APPROX. MID  
SCALE

f. Position probe with collar flat against titanium hole reference standard, which is part of 74D110201-1001 reference standard set, with probe end extending into 5/16 inch dia hole, of reference standard and coil away from corner EDM notch, see figure 2.

g. NULL tester.

(1) Press NULL and hold until flying dot on CRT stops moving.

(2) Position flying dot at intersection of x and y axes on CRT, center of display, using HORIZONTAL POSITION and/or VERTICAL POSITION.

#### NOTE

To avoid confusion during tester setup and use, erasing many traces displayed may be required. Erasing may be done by pressing ERASE.

h. Verify correct null point; turn ROTATION one full revolution. If center of circle formed by trace is not approximately centered on display or is more than one small division in diameter, adjust as below:

(1) If center of circle formed by trace is not centered on CRT, use HORIZONTAL POSITION, VERTICAL POSITION, and ROTATION to position center of circle trace on CRT, see figure 2, CRT's 1 and 2.

(2) If circle formed by trace is larger than one small division in diameter, recenter flying dot using FINE NULL, see figure 2, CRT 3. Verify circle diameter by turning ROTATION 1 full revolution. If circle formed by trace is still larger than one small division in diameter, repeat substeps h(1) and h(2).

i. Position lift-off trace line on horizontal axis by doing substeps below:

(1) Position probe in hole with probe collar held firmly against reference standard.

(2) Move probe from side to side, see figure 2 and CRT 4.

(3) Repeat substeps (1) and (2) and simultaneously turn ROTATION, see figure 2, CRT 5. Continue until lift-off trace line is on horizontal axis with flying dot trace traveling from center of CRT to left of screen, see figure 2, CRT 6. A reasonable linear response should be observed although lift-off trace line may skew off horizontal axis.

j. Reset VERTICAL SENSITIVITY to 0.5 and press ERASE.

k. Rotate probe in hole to pass coil over 0.050 inch EDM corner notch. An upward response approximately 3 large divisions should form, see figure 2, CRT 7. GAIN may be used to get correct response height.

#### 16. Inspection Procedure.

a. Adjust probe collar with probe coil center extended 0.10 inch as shown in figure 3.

b. Insert probe into inspection hole.

c. Using NULL and VERTICAL POSITION, locate flying dot at or near center of CRT.

d. Scan inspection hole by rotating probe at constant rate, no more than rate required to get flaw response on reference standard. A response in upward direction that can be repeated is indication of crack, see figure 3, CRT 1.

e. Mark all areas that cause crack response with an aircraft marking pencil and record.

f. Adjust probe collar with probe coil center extended 0.015 inch and repeat steps b. through e.



## 17. POST INSPECTION CLEANING AND CORROSION CONTROL.

### WARNING

Dry cleaning solvent and methyl isobutyl ketone are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

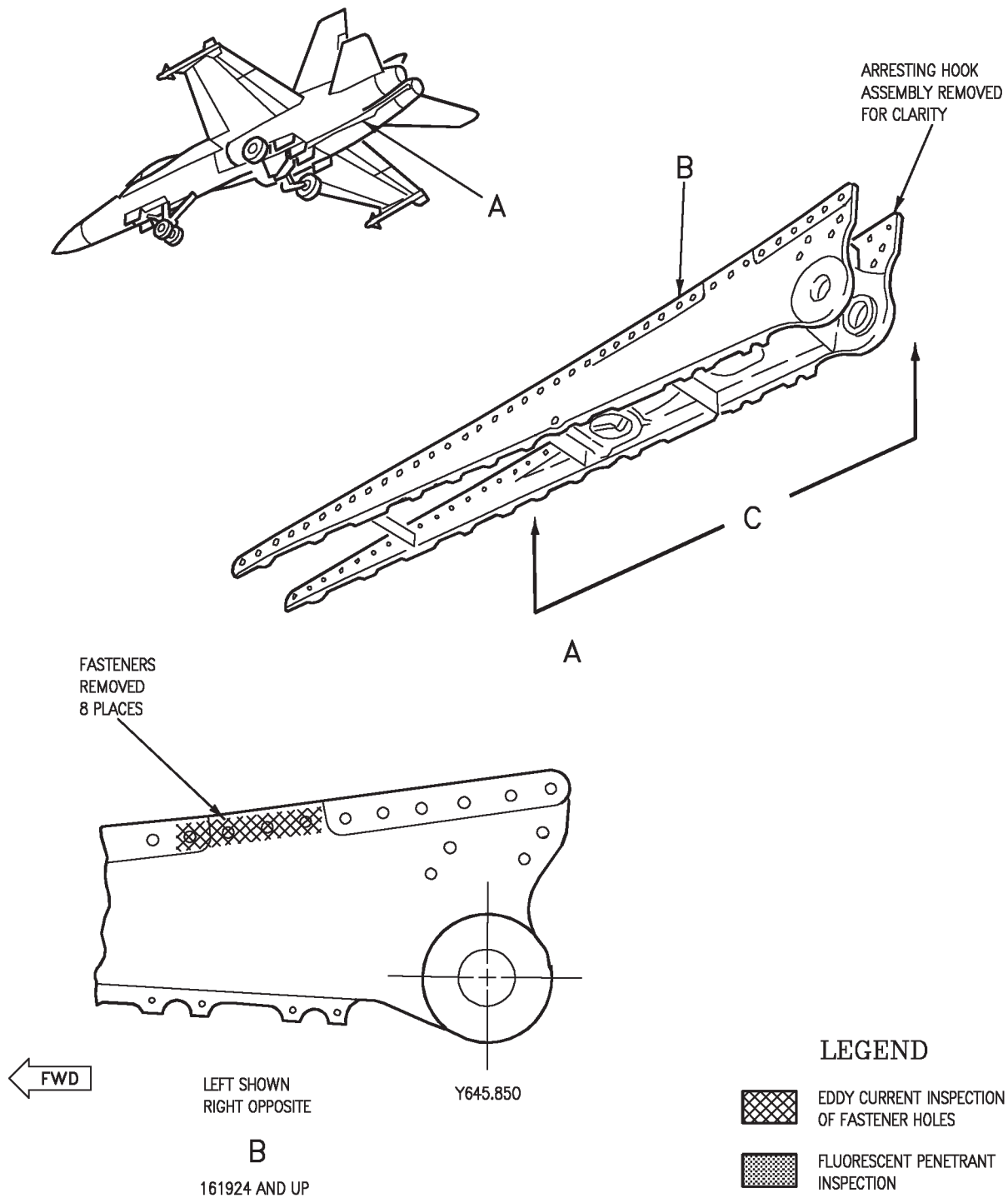
a. Clean inspection marks and materials from inspection areas with solvent moistened cloth.

b. Have inspection areas refinished (A1-F18AC-SRM-500, WP012 00).

## 18. SYSTEM SECURING.

a. Have fasteners reinstalled (A1-F18AC-SRM-200, WP004 06).

b. Have support fairing reinstalled (A1-F18AC-SRM-240, WP006 00).



**Figure 1. Arresting Hook Support Inspection Areas (Sheet 1)**

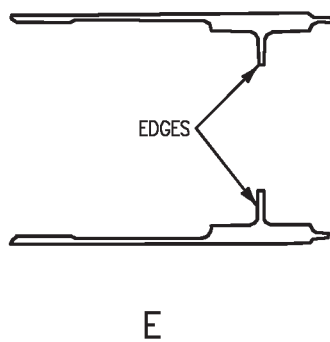
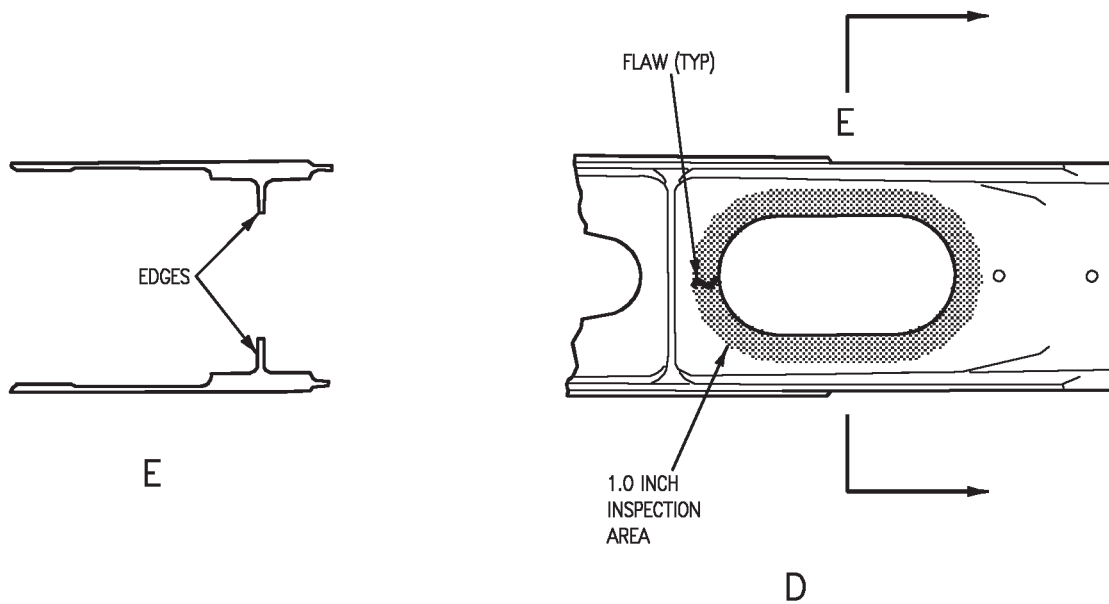
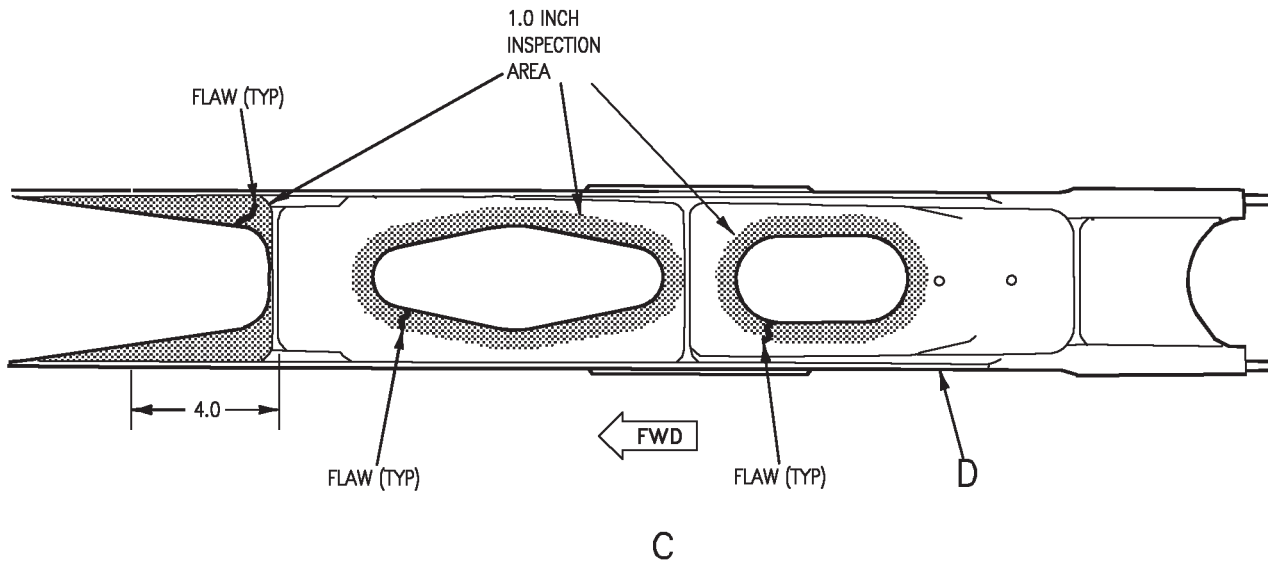


Figure 1. Arresting Hook Support Inspection Areas (Sheet 2)

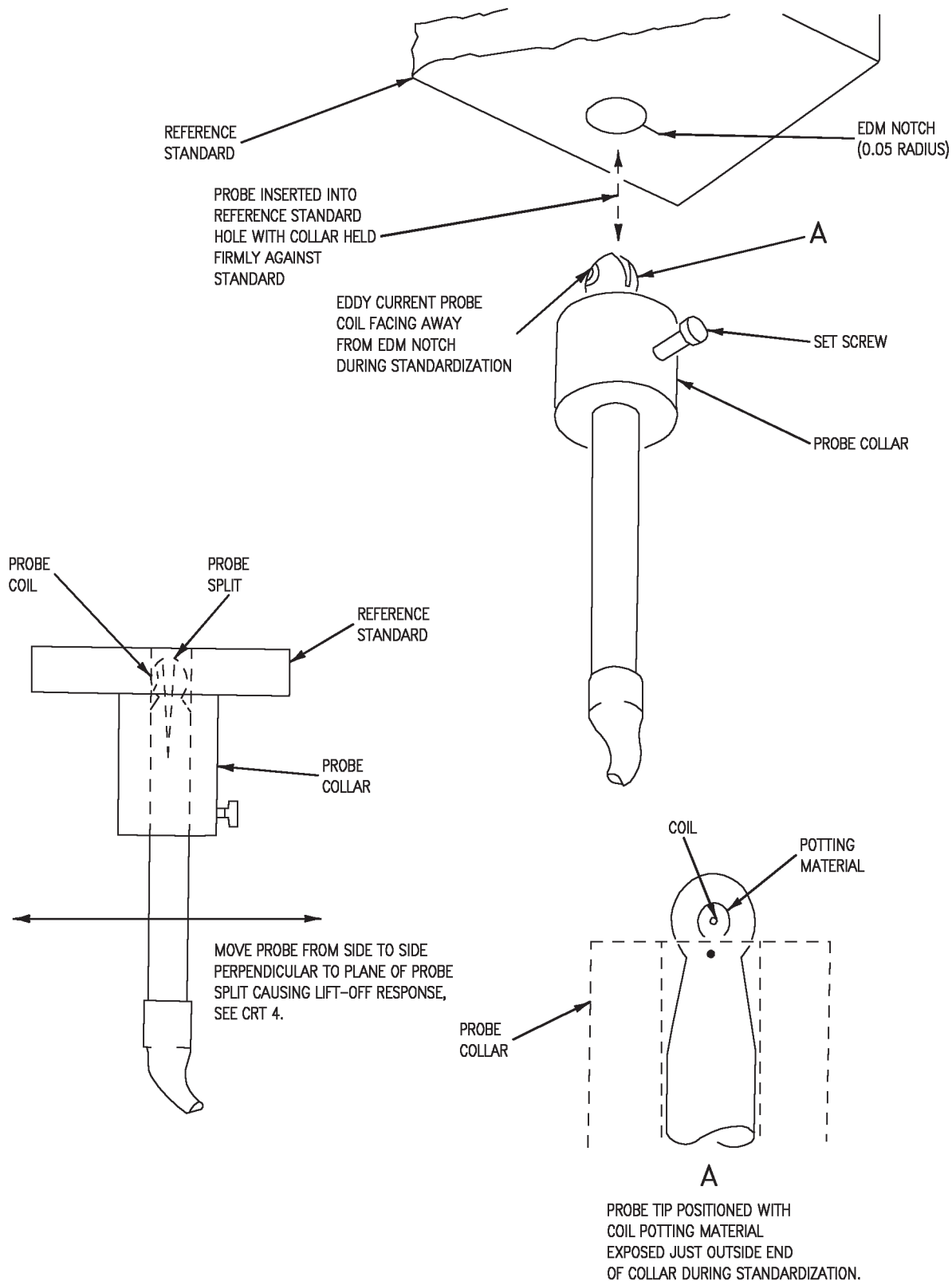
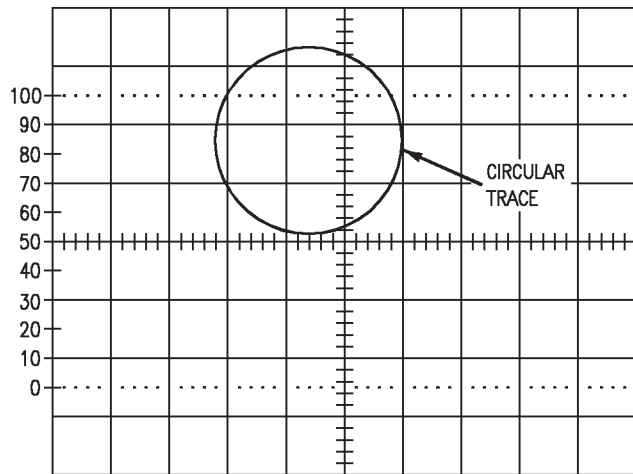
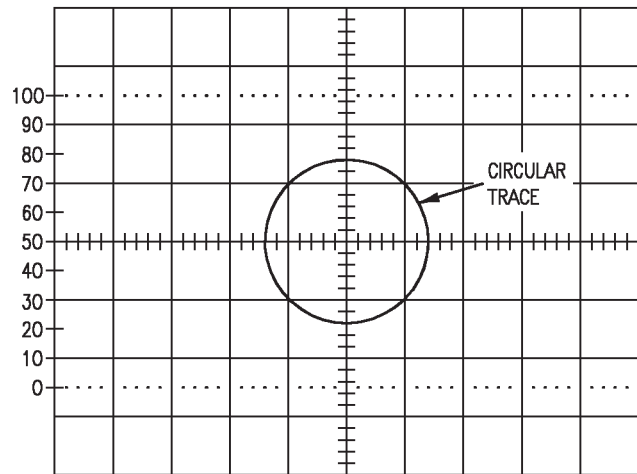


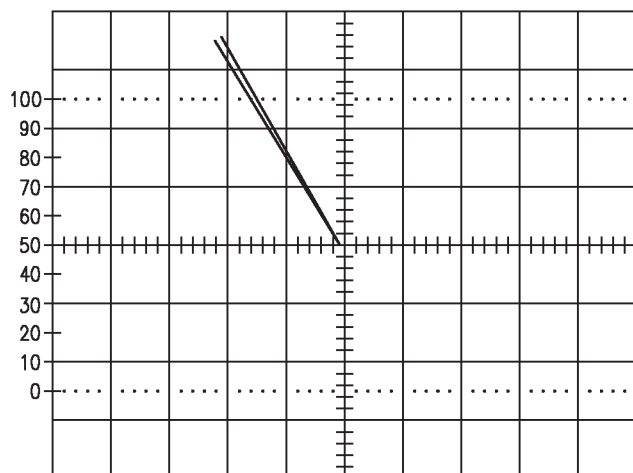
Figure 2. Eddy Current Equipment Standardization (Sheet 1)



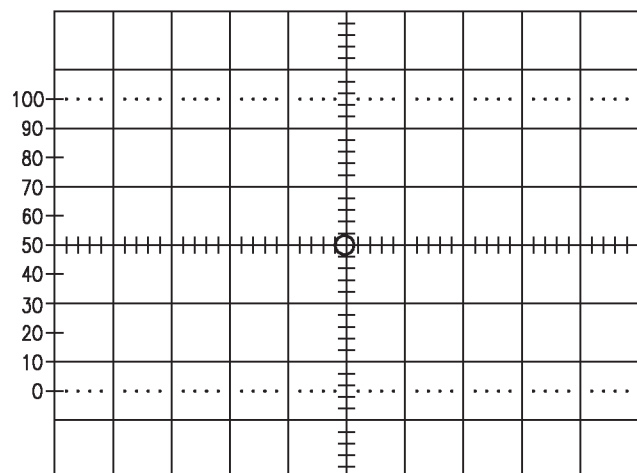
**CRT 1**  
CENTER CIRCLE TRACE



**CRT 2**  
CENTER CIRCLE

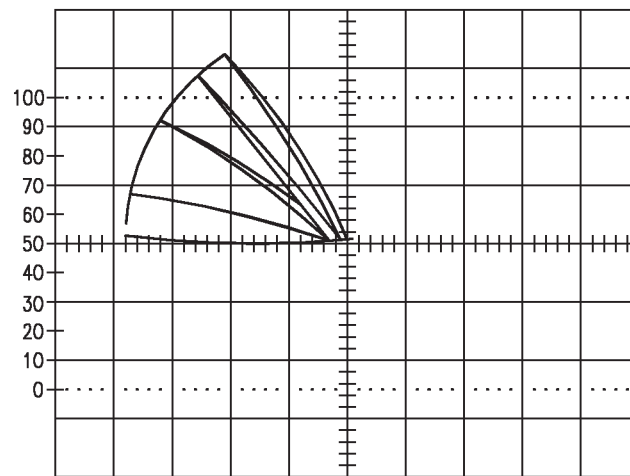


**CRT 4**  
LIFT-OFF TRACE LINE

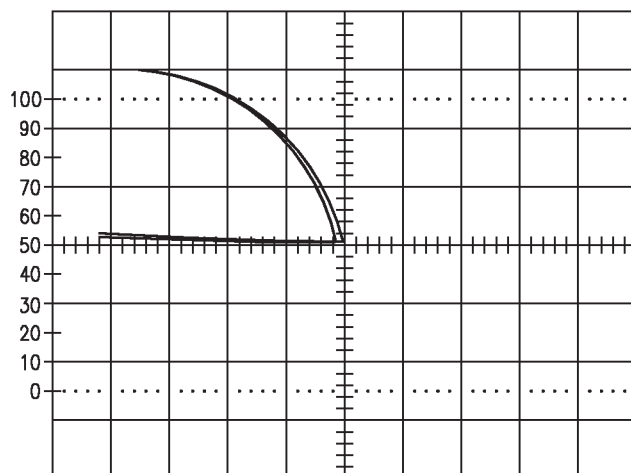


**CRT 3**  
CIRCLE MUST BE LESS  
THAN ONE SMALL DIVISION

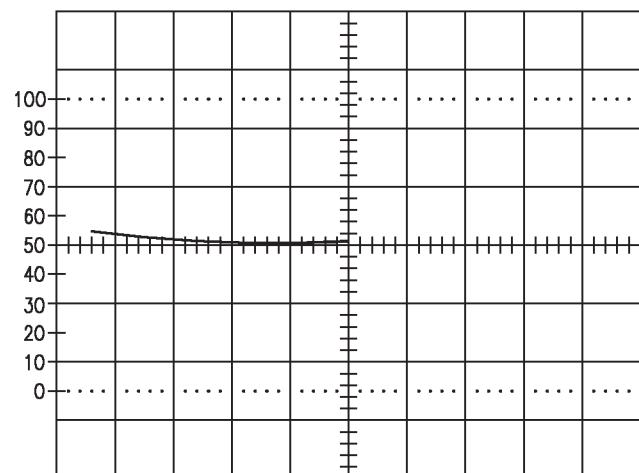
**Figure 2. Eddy Current Equipment Standardization (Sheet 2)**



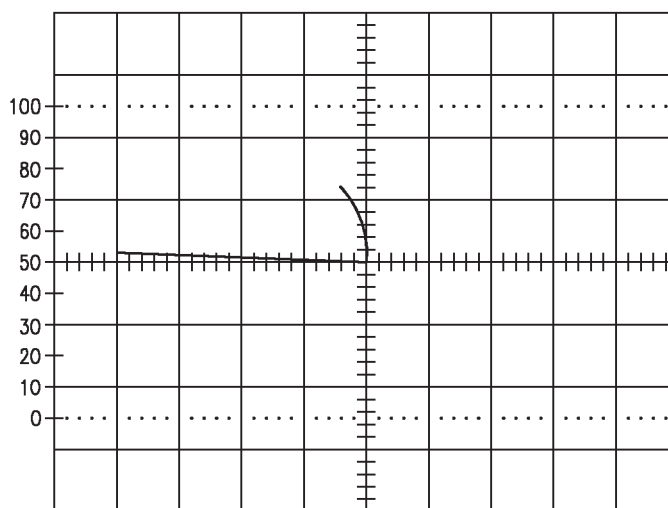
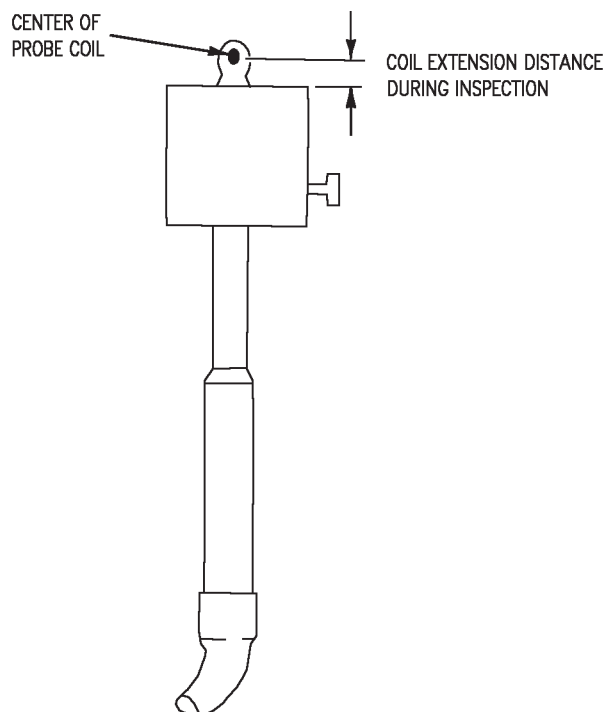
**CRT 5**  
LIFT-OFF TRACE LINES  
DURING ROTATION



**CRT 7**  
EDM RESPONSE FROM  
REFERENCE STANDARD



**CRT 6**  
LIFT-OFF TRACE LINE ON  
HORIZONTAL BASELINE



**CRT 1**  
TYPICAL FLAW RESPONSE

**Figure 3. Probe Collar Adjustment for Eddy Current Inspections**





## INTERMEDIATE MAINTENANCE

## NONDESTRUCTIVE INSPECTION

## ARRESTING HOOK HOLLOW PIN

## CRACKS

PART NO. 74A480607 AND 74A480619

This WP supersedes WP070 01, dated 15 December 1992.

## Reference Material

Naval Aviation Maintenance Program .....	OPNAVINST 4790.2
Nondestructive Inspection.....	A1-F18AC-SRM-300
Magnetic Particle Method.....	WP006 00
Landing Gear and Related Systems.....	A1-F18AC-130-300
Arresting Gear System .....	WP090 00

## Alphabetical Index

Subject	Page No.
Arresting Hook Hollow Pin .....	1
Defects .....	1
Post Inspection Cleaning and Corrosion Control.....	3
Primary Inspection Method .....	1
System Securing .....	3

## Record of Applicable Technical Directives

None

1. **ARRESTING HOOK HOLLOW PIN.**

2. Arresting hook hollow pin (hollow pin), see figure 1, is high strength steel. Outside surface of hollow pin is chrome plated and inside surface is cadmium plated with epoxy primer and polyurethane coatings. Hollow pins are same except for material. Part number 74A480607 is HP9-4-.30 steel and part number 74A480619 is AF 1410 steel. Both part number hollow pins are inspected using same procedure.

3. **DEFECTS.** Inspect hollow pin for cracks on outside and inside surfaces.

4. **PRIMARY INSPECTION METHOD.** Primary inspection method is magnetic particle.

5. **Personnel Qualifications.** Personnel doing this nondestructive inspection should be qualified and certified to do magnetic particle inspections per OPNAVINST 4790.2 SERIES, NDI Technicians, NEC 7225/MOS 6044.

6. **Preparation of Aircraft.** No special preparation required.

7. **Access.** Have hollow pin removed (A1-F18AC-130-300, WP090 00).

**Support Equipment Required****NOTE**

Alternate item type designations or part numbers are listed in parentheses.

**Part Number or Type Designation****Nomenclature**

DA200	Magnetic Inspection Probe
M-16 (ZB-26) 2480	Black Light Magnetic Particle Field Indicator

**Materials Required****NOTE**

Alternate item part numbers are shown indented.

**Specification or Part Number****Nomenclature**

PD680TY2 D 1153	Dry Cleaning Solvent Methyl Isobutyl Ketone
14AM	Magnetic Inspection Compound
M83953-1 or -2	Pencil, Aircraft Marking
MILC87962TYPE1	Cloth, Cleaning

**WARNING**

Dry cleaning solvent and methyl isobutyl ketone are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

**8. Preparation of Part.** Clean outside and inside surfaces of hollow pin to remove grease or foreign material using cleaning cloth moistened with dry cleaning solvent or methyl isobutyl ketone.

**9. Equipment Settings/Standardization/Setup.**

Select DC position and maximum current setting for the magnetic inspection probe (probe).

**10. Inspection Procedure.** Do inspection procedure for True Continuous Longitudinal Magnetization Using Probe (WP006 00) except as listed below:

a. Make darkened area for part inspection.

b. Position probe on hollow pin as shown in figure 2, position 1.

**WARNING**

Magnetic inspection compound may cause eye and skin irritation. Avoid contact with eyes, skin and clothing. Wash thoroughly after handling.

c. Turn probe ON and apply magnetic inspection compound to outside and inside surfaces of hollow pin while between probe legs.

d. Using black light, inspect entire length of hollow pin for cracks around complete circumference, see figure 1.

e. Mark location of all crack indications with an aircraft marking pencil and record.

f. Rotate hollow pin 90° for positions 2 through 4 using steps c. through e. for each position, see figure 2.

g. Demagnetize pin, Demagnetization (A1-F18AC-SRM-300, WP006 00).

h. Position contour probe on hollow pin as shown in figure 3, position 5.

i. Turn contour probe ON and apply magnetic inspection compound to outside and inside surfaces of hollow pin while between probe legs.

j. Using black light, inspect surface of hollow pin, near hole, for cracks in longitudinal direction, see figure 1.

k. Mark location of all crack indications with an aircraft marking pencil and record.

## NOTE

False indications may be seen on hollow pin surface near contour probe leg contact points. These indications are not near hole and should not be marked.

l. Position probe on position 6 and repeat steps i. through k., see figure 3.

m. Rotate hollow pin 180° to inspect opposite hole on positions 7 and 8 using steps i. through k., see figure 3.

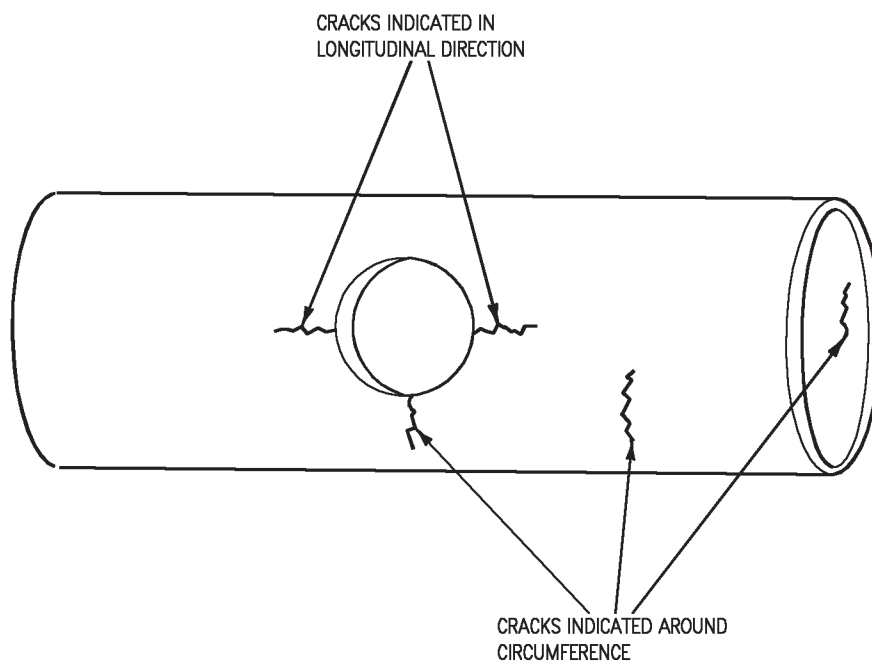
n. Demagnetize pin, Demagnetization  
■ (A1-F18AC-SRM-300, WP006 00).

## WARNING

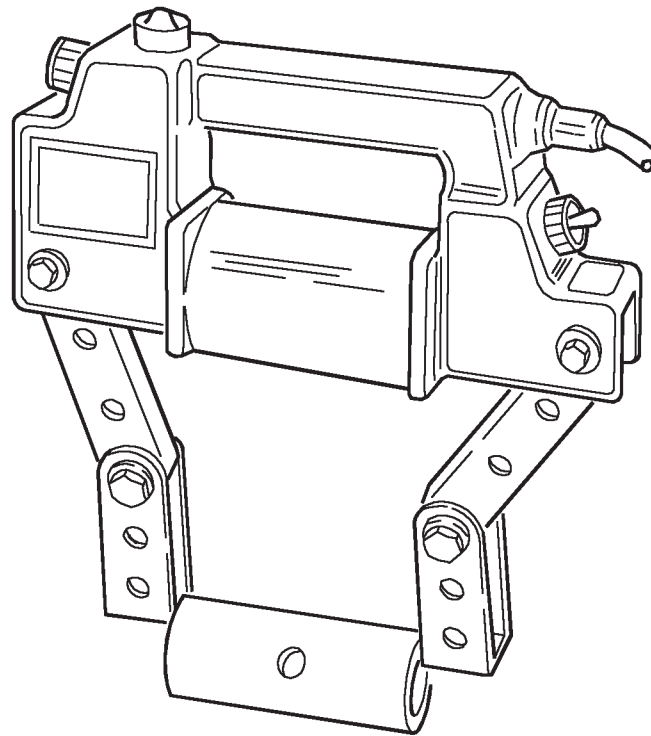
Dry cleaning solvent and methyl isobutyl ketone are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

11. **POST INSPECTION CLEANING AND CORROSION CONTROL.** If no cracks are found, clean inspection material from outer and inner surfaces of hollow pin using cleaning cloth moistened with dry cleaning solvent or methyl isobutyl ketone.

12. **SYSTEM SECURING.** Reinstall acceptable hollow pin (A1-F18AC-130-300, WP090 00).

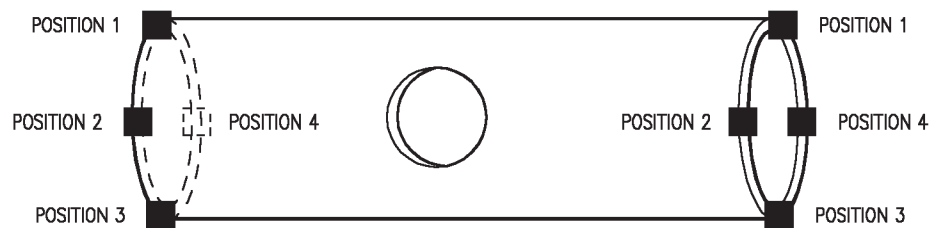


**Figure 1. Crack Directions On Arresting Hook Hollow Pin**



A

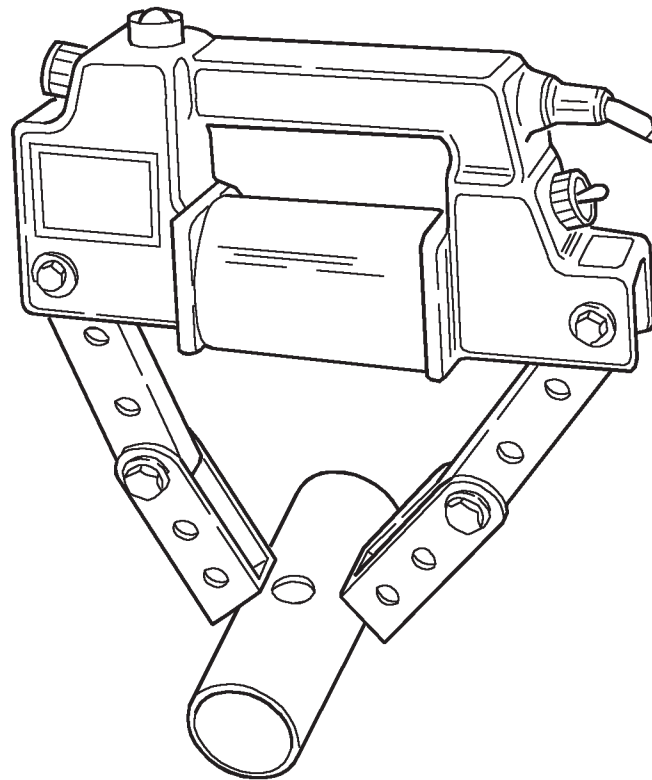
INSPECTION POSITION 1



B

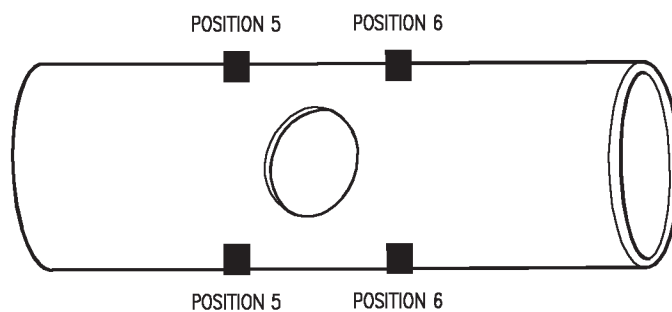
INSPECTION POSITIONS  
1 THROUGH 4

**Figure 2. Magnetic Particle Inspection for Circumferential Cracks**



A

INSPECTION POSITIONS  
5 OR 6 AND 7 OR 8



B

POSITIONS 7 AND 8 ARE SAME AS  
POSITIONS 5 AND 6 EXCEPT HOLLOW  
PIN IS ROTATED 180° TO INSPECT AROUND  
OPPOSITE HOLE

**Figure 3. Magnetic Particle Inspection for Longitudinal Cracks Near Holes**

## INTERMEDIATE MAINTENANCE

## NONDESTRUCTIVE INSPECTION

## ARRESTING HOOK SHANK, HOOK POINT SUPPORT AREA

## FATIGUE CRACKS

## PART NO. 74A480601

## Reference Material

Naval Aviation Maintenance Program .....	OPNAVINST 4790.2
Aircraft Weapons Systems Cleaning and Corrosion Control.....	NAVAIR 01-1A-509
Nondestructive Inspection Methods .....	NAVAIR 01-1A-16
Plane Captain Manual .....	A1-F18AC-PCM-000
Landing Gear and Related Systems.....	A1-F18AC-130-300
Arresting Hook Point .....	WP091 00
Nondestructive Inspection.....	A1-F18AC-SRM-300
Penetrant Method.....	WP004 00
Magnetic Particle Method.....	WP006 00

## Alphabetical Index

Subject	Page No.
Arresting Hook Shank, Hook Point Support Area .....	1
Backup Inspection Method .....	3
Defects .....	1
Post Inspection Cleaning and Corrosion Control.....	4
Primary Inspection Method .....	1
System Securing.....	4

## Record of Applicable Technical Directives

None

**1. ARRESTING HOOK SHANK, HOOK POINT SUPPORT AREA.**

2. Arresting hook shank is fabricated from HP9-4-.30 steel forging. Shank coating is ion vapor deposition (IVD) aluminum. Surface finish is epoxy primer and polyurethane coatings. Hook point area is subjected to tension loading.

3. **DEFECTS.** Inspect for fatigue cracks in hook point support area.

4. **PRIMARY INSPECTION METHOD.** Primary inspection method is magnetic particle.

5. **Personnel Qualifications.** Personnel doing this nondestructive inspection should be qualified and certified to do magnetic particle inspections per OPNAVINST 4790.2 SERIES, NDI Technicians, NEC 7225/MOS 6044.

**Support Equipment Required****NOTE**

Alternate item type designations or part numbers are listed in parentheses.

<b>Part Number or Type Designation</b>	<b>Nomenclature</b>
DA200	Magnetic Inspection Probe
2480	Magnetic Particle Field Indicator
M-16 (ZB-26) —	Black Light, Portable 5 to 14 × Pocket Magnifier

**Materials Required****NOTE**

Alternate item specifications or part numbers are shown indented.

<b>Specification or Part Number</b>	<b>Nomenclature</b>
P-D-680, TYPE 2 D 1153	Dry Cleaning Solvent Methyl Isobutyl Ketone
14AM	Fluorescent Magnetic Particle Solution, Spray Can
A-A-883, TYPE 1	Pressure Sensitive Tape, Masking Tape
MIL-P-83953-2, TYPE 1, CLASS A or B, RED or BLACK	Aircraft Marking Pencil
ZZ-G-381, TYPE 1 STYLE 1, SMALL, MEDIUM, LARGE	Rubber Gloves
MIL-R-81294 TY1	Epoxy Paint Remover

6. **Preparation of Aircraft.** Be sure aircraft is grounded (A1-F18AC-PCM-000).

**WARNING**

To prevent death or injury to personnel or damage to equipment, area surrounding arresting gear travel must be clear of personnel and obstructions when selecting arresting hook control handle down.

7. **Access.** Have arresting gear lowered and supported at convenient working level. Have arresting hook point and attaching hardware removed to expose inspection area (A1-F18AC-130-300, WP091 00). See figure 1.

8. **Preparation of Part.**

a. Have paint removed from inspection area (NAVAIR 01-1A-509).

**WARNING**

Dry cleaning solvent and methyl Isobutyl ketone is flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

b. Clean inspection area with solvent moistened cloth to make sure inspection area is free of contamination or foreign material.

9. **Equipment Settings/Standardization/Setup.** Refer to magnetic particle method, (WP006 00 and NAVAIR 01-1A-16). Probe leg spacing is approximately 4 inches.

**CAUTION**

Probe method of magnetization shall be used. Pass no current through part to avoid possible arc burns.

10. **Inspection Procedure.** Without readjusting field strength of 30 pounds, DC control setting or 4 inch probe leg spacing, do below listed steps:

a. Make darkened inspection area.



b. Locate probe for inspection position 1 on inspection area as shown in figure 1.



Avoid overheating probe. Do not exceed duty cycle. Duty cycle is 2 minutes on, 2 minutes off.

c. Push test switch, immediately spray thin even coat of inspection material. Maintain magnetic field for 5 seconds after inspection material application.

d. Use black light and 5 to 14 × magnifier to view inspection area for cracks.

e. From inspection position 1, reposition probe legs on inspection area approximately 1/2 width of leg contact points. Repeat steps b through d until all of inspection area is covered.

f. Evaluate indications, mark location of any defect with an aircraft marking pencil and record.

### WARNING

Dry cleaning solvent and methyl isobutyl ketone are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

g. Clean inspection material from inspection area using solvent moistened cloth.

h. Demagnetize inspection area (WP006 00 and NAVAIR 01-1A-16).

i. Check demagnetization with, magnetic particle field indicator (WP006 00 and NAVAIR 01-1A-16).

11. **BACKUP INSPECTION METHOD.** Backup inspection method is fluorescent penetrant. Fluorescent penetrant inspection method may be used to verify indications detected by primary method.

12. **Personnel Qualifications.** Personnel doing this nondestructive inspection should be qualified and

certified to do liquid penetrant inspections per OPNAVINST 4790.2 SERIES, NDI Technicians, NEC 7225/MOS 6044.

## Support Equipment Required

### NOTE

Alternate item type designations or part numbers are listed in parentheses.

Part Number or Type Designation	Nomenclature
ZA43 (TT10) (XMA101)	Portable Fluorescent Penetrant Inspection Kit
—	5 to 14 × Pocket Magnifier
M-16	Black Light

## Materials Required

### NOTE

Alternate item specifications or part numbers are shown indented.

Specification or Part Number	Nomenclature
P-D-680, TYPE 2 D 1153	Dry Cleaning Solvent Methyl Isobutyl Ketone
A-A-883, TYPE 1	Pressure Sensitive Tape, Masking Tape
MIL-P-83953-2, TYPE 1, CLASS A or B, RED or BLACK	Aircraft Marking Pencil
ZZ-G-381, TYPE 1, STYLE 1, SMALL, MEDIUM, LARGE	Rubber Gloves
A-A-1048TY1 CL1GRIT400X9X11	Aluminum Oxide Abrasive Cloth

13. **Preparation of Aircraft.** Same as primary method.

14. **Access.** Same as primary method.

15. **Preparation of Part.**

## 16. Preparation of Part.

### NOTE

When using aluminum oxide abrasive cloth, stroking should be parallel with expected crack orientation. See figure 1.

- a. Have IVD coating removed from inspection area using 400 grit aluminum oxide abrasive cloth.

### WARNING

Dry cleaning solvent and methyl isobutyl ketone are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

- b. Clean inspection area with solvent moistened cloth to make sure inspection area is free of contamination or foreign material.

## 17. Inspection Procedure.

- a. Do type I, method C fluorescent penetrant inspection (WP004 00 and NAVAIR 01-1A-16).

- b. After removing excess penetrant, spray thin film of developer on inspection surface.

- c. Use black light and 5 TO 14 × magnifier to view inspection area for cracks.

- d. Evaluate indications, mark location of any defect with aircraft marking pencil.

## 18. POST INSPECTION CLEANING AND CORROSION CONTROL.

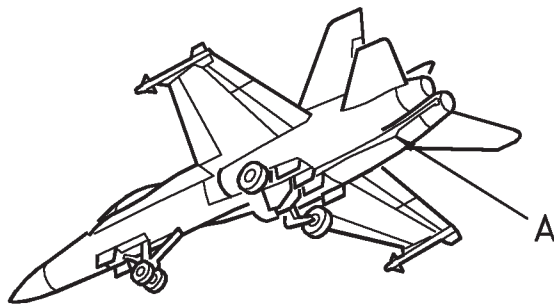
### WARNING

- a. Clean inspection material from part with solvent moistened cloth.

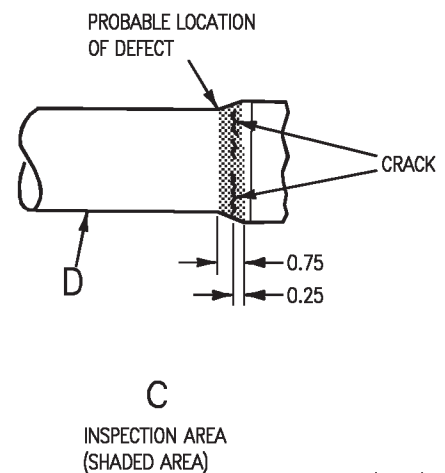
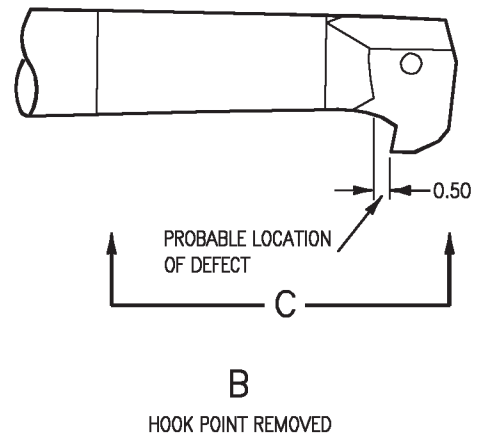
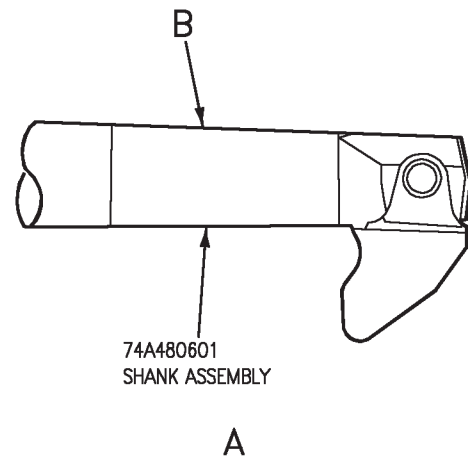
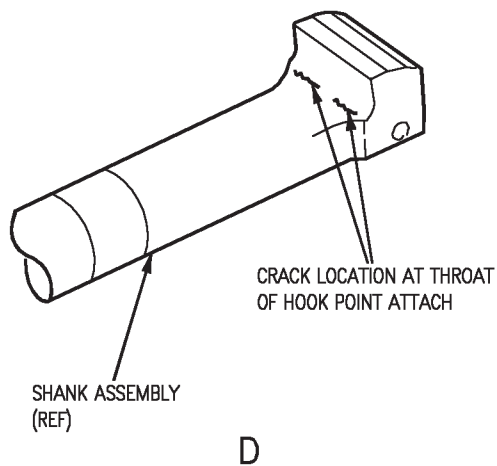
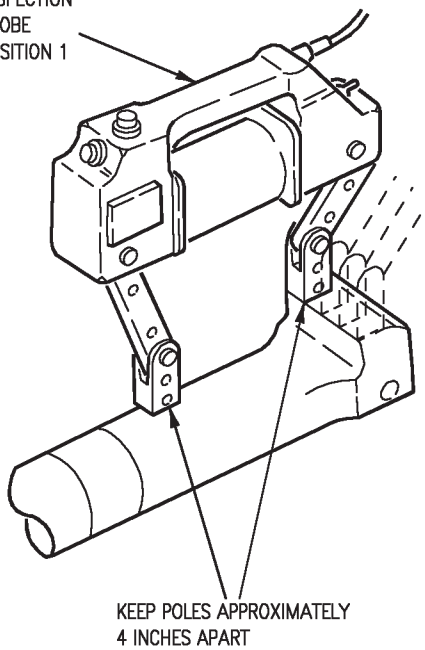
- b. Refinish inspection area.

## 19. SYSTEM SECURING.

- a. Have arresting hook point and attaching hardware reinstalled and arresting gear raised (A1-F18AC-130-300, WP091 00).



MAGNETIC  
INSPECTION  
PROBE  
POSITION 1



**Figure 1. Arresting Hook Shank, Hook Point Support Area, Cracks**



## ORGANIZATIONAL, INTERMEDIATE, AND DEPOT MAINTENANCE

## NONDESTRUCTIVE INSPECTION

## OUTER WING LOWER FIXED TRAILING EDGE PANEL

## DELAMINATIONS

## PART NO. 74A150823

This WP Supersedes WP072 00, datee 15 December 1992

## Reference Material

Plane Captain Manual .....	A1-F18AC-PCM-000
Naval Aviation Maintenance Program .....	OPNAVINST 4790.2
Nondestructive Inspection.....	A1-F18AC-SRM-300
General Information .....	WP003 00
Pulse-Echo Longitudinal, Contact, with Delay Line For Composite Laminate Materials.....	WP008 12
Pulse-Echo, Longitudinal Wave Contact, with Delay Line, For Composite Laminate Materials.....	WP008 03

## Alphabetical Index

Subject	Page No.
Outer Wing Lower Fixed Trailing Edge Panel.....	1
Defects .....	1
Post Inspection Cleaning and Corrosion Control.....	4
Primary Inspection Method .....	1
Ultrasonic Method Using C-398 Ultrasonic Tester.....	2
Ultrasonic Method Using MXU-715/E Ultrasonic Tester.....	3

## Record of Applicable Technical Directives

None

**1. OUTER WING LOWER FIXED TRAILING EDGE PANEL.**

2. Outer wing, lower fixed trailing edge panel skin assembly, see figure 1, is solid graphite epoxy laminate material. Surface finish is epoxy primer and polyurethane coatings.

3. **DEFECTS.** Inspect for delaminations, see figure 1. Example of delaminations that may develop are contained in (WP003 00).

4. **PRIMARY INSPECTION METHOD.** Primary inspection method is ultrasonic.

5. **Personnel Qualifications.** Personnel doing this nondestructive inspection should be qualified and certified to do ultrasonic inspections per

OPNAVINST 4790.2 SERIES, NDI Technicians,  
NEC 7225/MOS 6044.

6. **Preparation of Aircraft.** No special preparation required.

7. **Access.** No special access required.

#### 8. ULTRASONIC METHOD USING C-398 ULTRASONIC TESTER.

### Support Equipment Required

#### NOTE

Alternate item type designations or part numbers are listed in parentheses.

Part Number or Type Designation	Nomenclature
C-398 (303B)	Ultrasonic Flaw Detector
57A2271 or EQUIVALENT	Microdot to BNC Connecting Cable, 2 Req'd.
57A2276 or EQUIVALENT	0°, 0.500 Dia., 2.25 MHz, Contact, Delay Line, Search Unit, 2 Req'd.
GD0504	0°, 0.250 Dia., 5 MHz, Contact, Delay Line, Search Unit
74D110175-1001	Graphite Epoxy Refer- ence Standard Set Containing the Following:
74D111295-1009	Graphite Epoxy Flat Bottom Hole Reference Standard for Laminates up to 0.450 Inch

### Materials Required

Specification or Part Number	Nomenclature
ULTRAGEL II MIL-G-81322	Couplant Aircraft Grease

### Materials Required (Continued)

Specification or Part Number	Nomenclature
MIL-P-83953-2, TYPE 1, CLASS A OR B, RED or BLACK	Aircraft Marking Pencil
P-D-680, TYPE 2 D 1153	Dry Cleaning Solvent Methyl Isobutyl Ketone
CCC-C-46, TYPE 1, CLASS 4	Cleaning Cloth
—	Straight Edge

#### WARNING

Dry cleaning solvent and methyl isobutyl ketone are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

9. **Preparation of Part.** Clean inspection areas with solvent moistened cloth to be sure inspection areas are free of contamination or foreign material.

#### WARNING

Make sure safety precautions for electrical, static, grounding when using ultrasonic equipment near aircraft fuel cells, oxygen systems, electrical systems, electronic systems, and stores are followed (A1-F18AC-PCM-000).

10. **Equipment Settings/Standardization/Setup.** See figures 2 and 3. Do equipment standardization/setup per (WP008 03), except as specified below. See figure 3 for CRT's.

a. Set up using 74D111295-1009 reference standard, using 0.300 deep flat bottom hole (FBH), see figure 2.

b. Adjust SWEEP DELAY and HORIZONTAL SWEEP RANGE until Delay Line/Part Surface interface response and 0.300 deep FBH response are as shown in figure 3, CRT 1.

c. Adjust FINE GAIN, and COARSE GAIN, if required, so response from 0.300 deep FBH is located at 80 to 90 percent CRT height.

11. **Inspection Procedure.** Do pulse-echo inspection of areas shown in figure 1 per (WP008 03) and following:

a. Be sure received responses are similar to figure 3, CRT 2. Be sure back surface response is within specified range on horizontal base line.

b. Using straight edge, follow scan plan illustrated in figure 1. Index 0.125 between scans.

c. Do paragraph 16.

12. **ULTRASONIC METHOD USING MXU-715/E ULTRASONIC TESTER.**

### Support Equipment Required

Part Number or Type Designation	Nomenclature
1642AS100-1	Ultrasonic Flaw Detector, MXU-715/E, Magnaflux
57A2271 or EQUIVALENT	Microdot to BNC Connecting Cable, 2 Req'd.
57A2276 or EQUIVALENT	0°, 0.500 Dia., 2.25 MHz, Contact, Delay Line, Search Unit, 2 Req'd.
GD0504	0°, 0.250 Dia., 5 MHz, Contact, Delay Line, Search Unit
74D110175-1001	Graphite Epoxy Reference Standard Set Containing the Following:
74D111295-1009	Graphite Epoxy Flat Bottom Hole Reference Standard for Laminates up to 0.450 Inch

### Materials Required

Specification or Part Number	Nomenclature
ULTRAGEL II	Couplant
MIL-G-81322	Aircraft Grease
MIL-P-83953-2, TYPE 1, CLASS A OR B, RED or BLACK	Aircraft Marking Pencil
P-D-680, TYPE 2 D 1153	Dry Cleaning Solvent Methyl Isobutyl Ketone
CCC-C-46, TYPE 1, CLASS 4	Cleaning Cloth
—	Straight Edge

### WARNING

Dry cleaning solvent and methyl isobutyl ketone are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

13. **Preparation of Part.** Clean inspection areas with solvent moistened cloth to be sure inspection areas are free of contamination or foreign material.

### WARNING

Make sure safety precautions for electrical, static, grounding when using ultrasonic equipment near aircraft fuel cells, oxygen systems, electrical systems, electronic systems, and stores are followed (A1-F18AC-PCM-000).

14. **Equipment Settings/Standardization/Setup.** See figures 2 and 3. Do equipment standardization/setup per (WP008 12), except as specified below. See figure 3 for CRT's.

a. Set up using 74D111295-1009 reference standard, using 0.300 deep flat bottom hole (FBH), see figure 2.

b. Adjust HORIZONTAL SWEEP DELAY and HORIZONTAL SWEEP LENGTH until Delay

Line/Part Surface interface response and 0.300 deep FBH response are as shown in figure 3, CRT 1.

c. Adjust FINE GAIN, and COARSE GAIN, if required, so response from 0.300 deep FBH is located at 80 to 90 percent CRT height.

15. **Inspection Procedure.** Do pulse-echo inspection of areas shown in figure 1 per (WP008 12) and following:

a. Be sure received responses are similar to figure 3, CRT 2. Be sure back surface response is within specified range on horizontal base line.

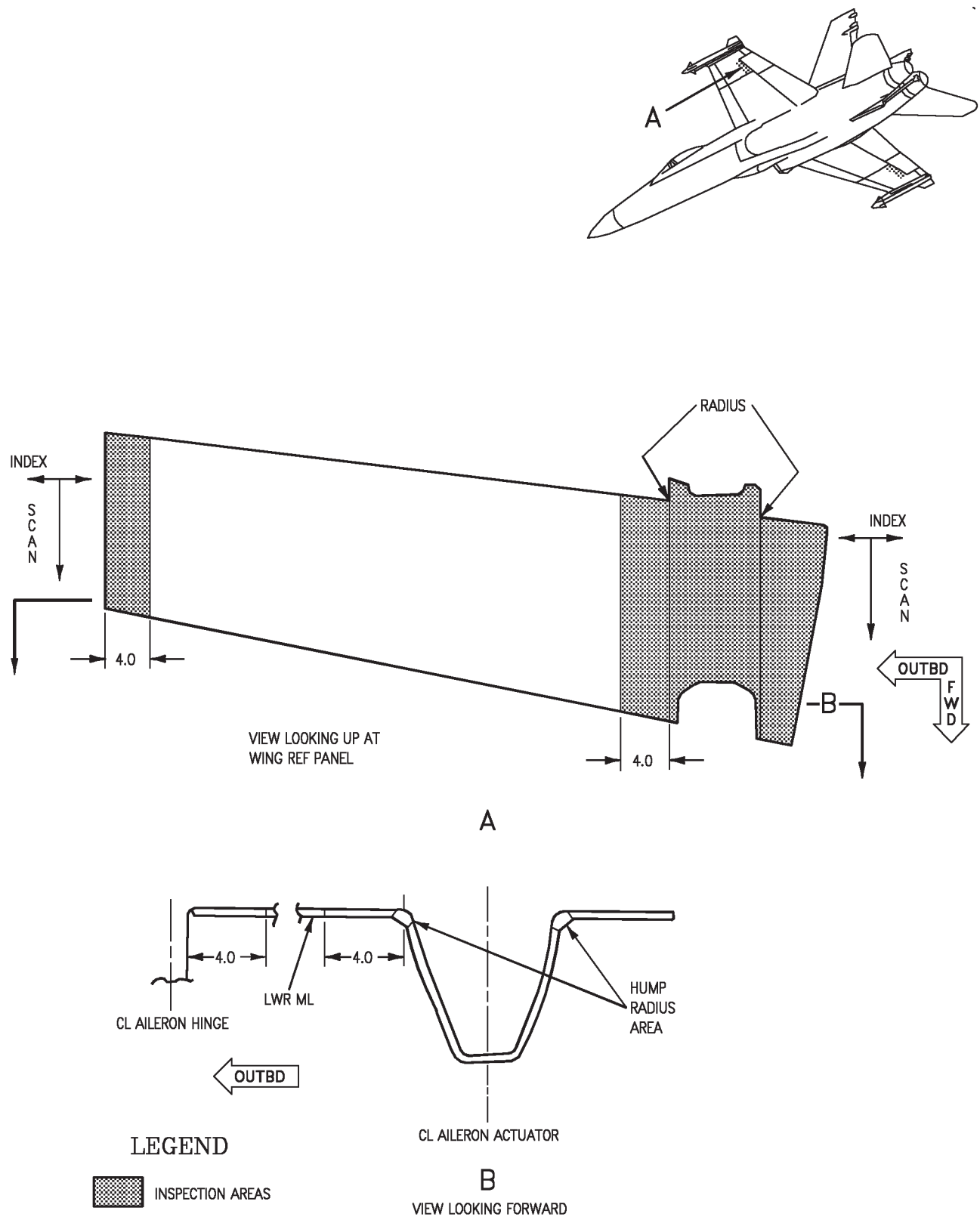
b. Using straight edge, follow scan plan illustrated in figure 1. Index 0.125 between scans.

### WARNING

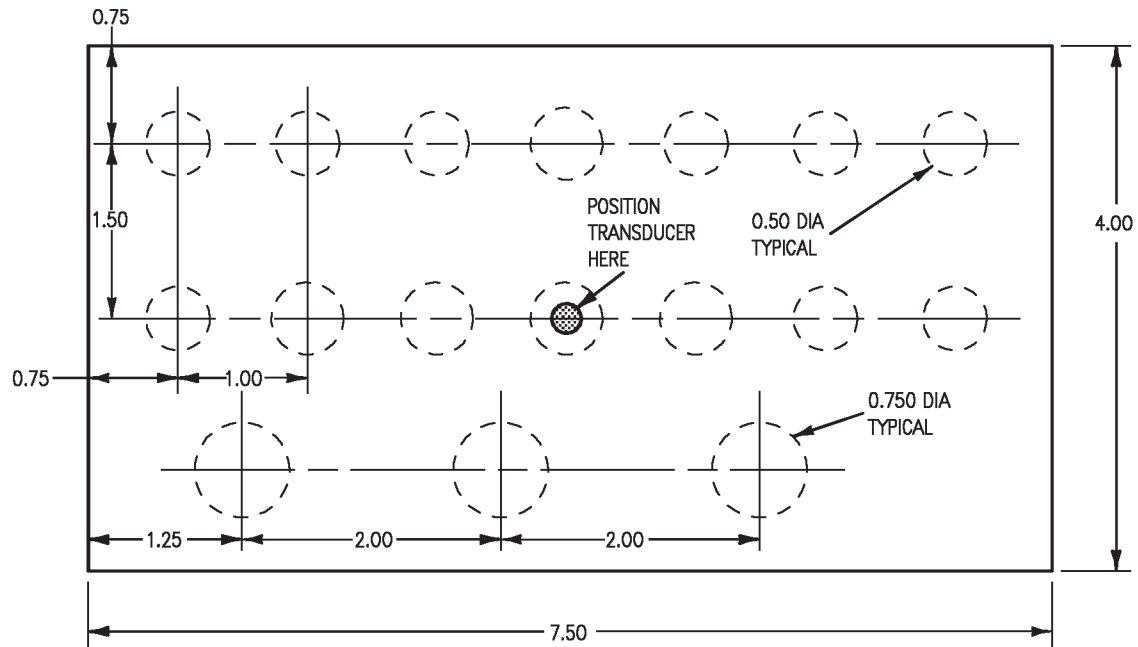
Dry cleaning solvent and methyl isobutyl ketone are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

16. **POST INSPECTION CLEANING AND CORROSION CONTROL.** Clean couplant and markings from inspection areas with solvent moistened cloth.





**Figure 1. Outer Wing Lower Fixed Trailing Edge Skin Assembly**



**74D111295-1009**

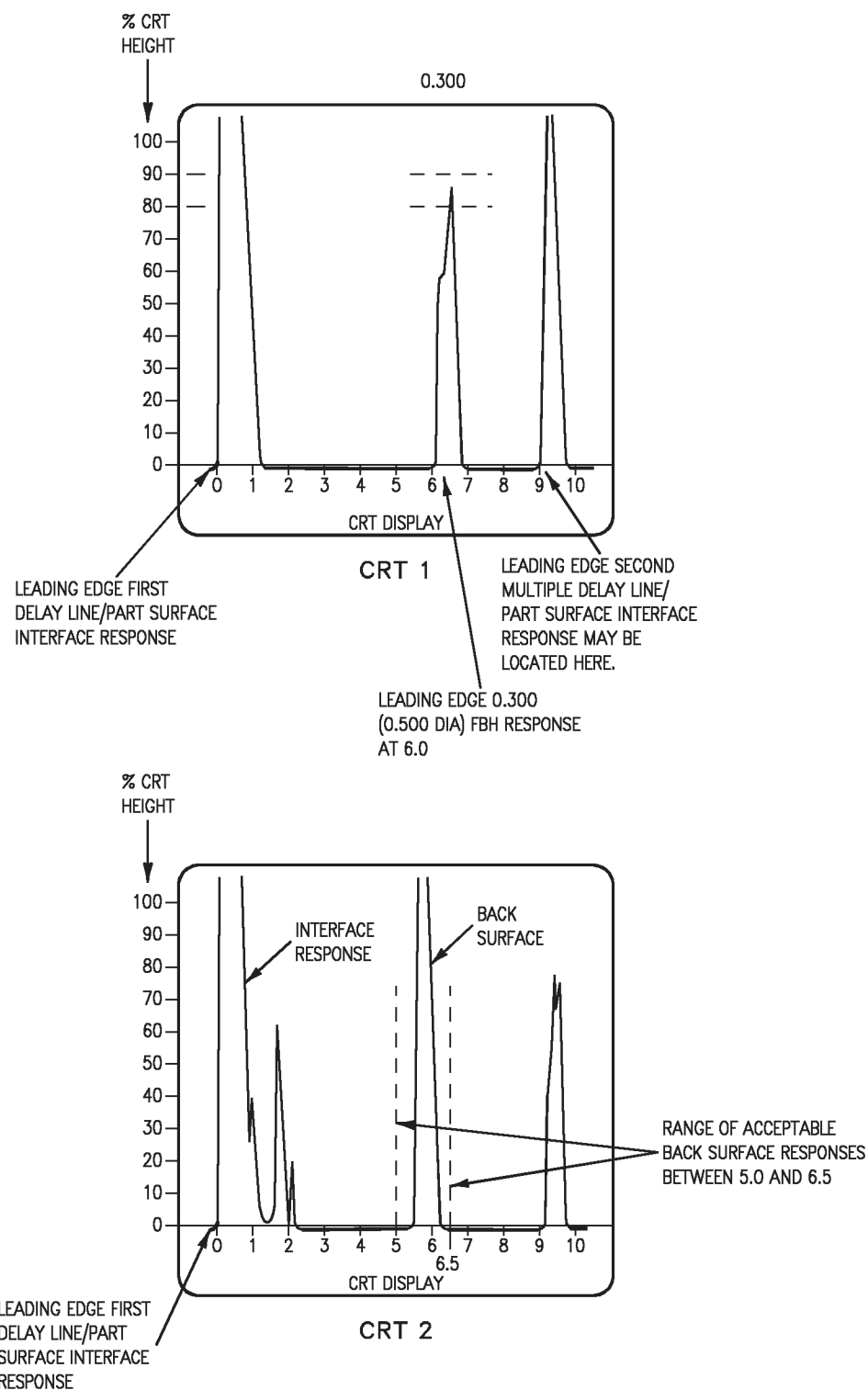
GRAPHITE EPOXY LAMINATE

FLAT BOTTOM HOLE ULTRASONIC REFERENCE  
STANDARD FOR LAMINATES TO 0.450 INCH.

## LEGEND



STANDARDIZATION/  
SETUP LOCATION.



**Figure 3. Ultrasonic Responses**



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**INTERMEDIATE AND DEPOT MAINTENANCE****NONDESTRUCTIVE INSPECTION****FORWARD FUSELAGE BONDED HONEYCOMB CORE DOORS****SKIN TO CORE UNBONDS AND EDGE DELAMINATIONS****DOOR 6 PART NO. 74A315068****DOOR 10 PART NO. 74A315069****DOOR 13 PART NO. 74A315071****DOOR 14 PART NO. 74A315073**

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**Reference Material**

Plane Captain Manual .....	A1-F18AC-PCM-000
Nondestructive Inspection.....	A1-F18AC-SRM-300
General Information .....	WP003 00
Ultrasonic Through Transmission Contact Testing, Standardization, and Inspection Procedures For Composite Laminate Skins Bonded to Honeycomb Core.....	WP008 01
Pulse-Echo, Longitudinal Wave Contact, Without Delay Line, For Composite Laminate Material .....	WP008 02
Pulse-Echo, Longitudinal Wave Contact, With Delay Line, For Composite Laminate Material To Honeycomb Core.....	WP008 04
Ultrasonic Through Transmission Contact Testing, Standardization and Inspection Procedures for Composite Laminate and Metallic Skins Bonded to Honeycomb Core .....	WP008 10
Pulse-Echo Longitudinal, Contact, Without Delay Line, for Composite Laminate Materials .....	WP008 11
Pulse-Echo Longitudinal, Contact, With Delay Line, for Composite Laminate Material Bonded to Honeycomb core .....	WP008 13
Naval Aviation Maintenance Program .....	OPNAVINST 4790.2

**Alphabetical Index**

<b>Subject</b>	<b>Page No.</b>
Forward Fuselage Bonded Honeycomb Core Doors .....	2
Damage Evaluation, Using C-398 .....	6
Damage Evaluation, Using MXU-715/E.....	6
Defects .....	2
Post Inspection Cleaning and Corrosion Control.....	7
Primary Inspection Method .....	2

## Alphabetical Index (Continued)

Subject	Page No.
Repair Evaluation, Using C-398 .....	7
Repair Evaluation, Using MXU-715/E.....	6
Ultrasonic Method Using C-398 Ultrasonic Flaw Detector .....	2
Ultrasonic Method Using MXU-715/E Ultrasonic Flaw Detector .....	5

## Record of Applicable Technical Directives

None

## 1. FORWARD FUSELAGE BONDED HONEYCOMB CORE DOORS.

2. Forward Fuselage bonded honeycomb core doors (forward fuselage doors), see figure 1, are bonded honeycomb assemblies. Honeycomb core is 0.125, hexagonal cell, 5056 aluminum alloy. Skins are graphite epoxy with one ply fiberglass overlay on inner surface. Surface finish is epoxy primer and polyurethane coating.

3. **DEFECTS.** Inspect for skin to core unbonds and edge delaminations. Examples of skin to core unbonds and delaminations that may develop in bonded assembly are contained in (WP003 00).

4. **PRIMARY INSPECTION METHOD.** Primary inspection method is ultrasonic through transmission and pulse-echo.

5. **Personnel Qualifications.** Personnel doing this nondestructive inspection should be qualified and certified to do ultrasonic inspections per OPNAVINST 4790.2 SERIES, NDI Technicians, NEC 7225/MOS 6044.

6. **Preparation of Aircraft.** No special preparation required.

7. **Access.** No special access required.

## 8. ULTRASONIC METHOD USING C-398 ULTRASONIC TESTER.

## Support Equipment Required

## NOTE

Alternate item type designations or part numbers are listed in parentheses.

Part Number or Type Designation	Nomenclature
C-398 (303B)	Ultrasonic Flaw Detector
57A2271 or EQUIVALENT	Microdot to BNC Connecting Cable, 2 Req'd.
57A2276 or EQUIVALENT	0°, 0.500 Dia., 2.25 MHz, Contact, Delay Line, Search Unit, 2 Req'd.
57A2214 or EQUIVALENT	0°, 0.25 Dia., 5 MHz, Contact, Delay Line, Search Unit, 2 Req'd.
74D110175-1001	Graphite Epoxy Reference Standard Set Containing the Following:
74D111295-1009	Graphite Epoxy Flat Bottom Hole Reference Standard for Laminates up to 0.450 Inch

## Support Equipment Required (Continued)

### NOTE

Alternate item type designations or part numbers are listed in parentheses.

#### Part Number or Type Designation

#### Nomenclature

74D111295-1005	Honeycomb Reference Standard With Graphite Epoxy Skin for Sandwich Assemblies Less Than 1 Inch
----------------	---

## Materials Required

### NOTE

Alternate item specifications or part numbers are shown indented.

#### Specification or Part Number

#### Nomenclature

ULTRAGEL II MIL-G-81322	Couplant
MIL-P-83953-2, TYPE 1, CLASS A or B, RED or BLACK	Aircraft Marking Pencil
P-D-680, TYPE 2 D 1153	Dry Cleaning Solvent, Methyl Isobutyl Ketone

### WARNING

Dry cleaning solvent and methyl isobutyl ketone are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

9. **Preparation of Part.** Clean inner and outer surfaces of inspection area with solvent moistened cloth to make sure part is free of contamination or foreign matter.

### WARNING

Make sure safety precautions have been met for electrical, static, grounding when using ultrasonic equipment near aircraft fuel cells, oxygen systems, electronic systems, and stores (A1-F18AC-PCM-000).

10. **Equipment Setting/Standardization/Setup for Skin to Core Areas.** See figure 2. Do standardization per (WP008 01), except as below:

a. Use two 57A2276 search units and two microdot cables.

b. Use P-1 calibration point on applicable 74D111295 graphite/epoxy skinned honeycomb core sandwich assembly reference standard.

11. **Inspection Procedure for Skin to Core Areas.** See figure 3. After standardization, inspect skin to core area of applicable door(s) per (WP008 01), except as specified below:

a. Apply couplant to both surfaces of inspection area(s).

b. Make sure initial pulse width does not interfere with location of received response. If required, switch position of search units on microdot cables or use different search unit on receiver cable.

c. If area is covered by aluminum foil tape, make sure foil tape is not cause of defect response.

d. Use ultrasonic pulse-echo per (WP008 04) to determine if suspect areas are result of skin delaminations. Do pulse-echo inspection on both surfaces to help identify location of flaws causing through transmission unbond response.

12. **Equipment Settings/Standardization/Setup for Solid Laminate Area.** Do standardization for laminates less than 0.450 thick per (WP008 02), making sure trailing edge of initial pulse is located at less than 1 large division when 0.100 inch FBH response is 80 to 90 percent CRT height.

## WARNING

Make sure safety precautions have been met for electrical, static, grounding when using ultrasonic equipment near aircraft fuel cells, oxygen systems, electronic systems, and stores (A1-F18AC-PCM-000).

### 13. Inspection Procedure for Solid Laminate

**Areas.** Inspect solid laminate areas per (WP008 02) and following:

- a. Apply couplant to solid laminate inspection area where laminate thickness is known.
- b. Make sure leading edge of back surface response is located at correct location on horizontal baseline when peak amplitude is 80 to 90 percent CRT height, see figure 4, CRTs 1 through 4.
- c. Scan area to be inspected, finger damping back surface response as often, as required, to make sure correct response is being received. Finger damp by placing couplant on end of finger and touching opposite surface. As finger touches and is then removed from part surface, reflected response on CRT will move up and down as it is damped, indicating good bond.
- d. Remove section of foil tape, if required, to damp back surface. Foil tape may not yield correct back surface damping response.
- e. For inspection responses in addition to those described in (WP008 02), refer to figure 4.
- f. Use pulse-echo mapping techniques per (WP008 02) to determine extent of flaw indication.

### 14. DAMAGE EVALUATION USING C-398.

Do skin to core and solid laminate damage evaluation per (WP008 01) except as below:

- a. Use couplant which will have no effect on patch bonding or edge filling.
- b. For local damaged area, scan 2 to 3 inches around visible damage to make sure additional surface defects will be detected.
- c. Use radiography to detect subsurface crushed core, laminate cracks, adhesive cracks, and additional adhesive.

d. If determined patch will be bonded to damaged area, scan area not inspected above, which will lie under patch to make sure subsurface damage or additional adhesive does not exist in this area and will not interfere with repair evaluation.

**15. REPAIR EVALUATION USING C-398.** Do repair evaluation of typical skin to core bonded repair areas (WP008 01) and as below:

a. For edge fill with paste adhesive in solid laminate areas, do standardization of paragraph 18, except as below:

(1) Apply couplant to area next to edge filled repair area.

(2) Position search unit on area next to edge filled repair area, make sure correct back surface response is received. If possible, damp response to make sure correct response is being received, see figure 5, CRT 1.

(3) With back surface response 80 to 90 percent CRT height, move search unit over repair filled area and monitor back surface response.

(4) Back surface response peak amplitude should not change appreciably but intermediate response may be received from laminate/paste adhesive interface, see figure 5, CRT 2.

(5) Scan repair filled area and with aircraft marking pencil mark all areas where back surface response completely disappears. Use pulse-echo mapping techniques (WP008 02) to determine extent of edge filled area flaw.

b. For skin to core areas, do standardization of paragraph 20 and (WP008 01) except only 16 dB GAIN relative to nearby area is allowed, in area where core has been replaced.

c. Do paragraph 24.



16. ULTRASONIC METHOD USING MXU-715/E  
ULTRASONIC TESTER.

## Support Equipment Required

Part Number or Type Designation	Nomenclature
1642AS100-1	Ultrasonic Flaw Detector, MXU-715/E, Magnaflux
57A2271 or EQUIVALENT	Microdot to BNC Connecting Cable, 2 Req'd.
57A2276 or EQUIVALENT	0°, 0.500 Dia., 2.25 MHz, Contact, Delay Line, Search Unit, 2 Req'd.
57A2214 or EQUIVALENT	0°, 0.25 Dia., 5 MHz, Contact, Delay Line, Search Unit, 2 Req'd.
74D110175-1001	Graphite Epoxy Reference Standard Set Containing the Following:
74D111295-1009	Graphite Epoxy Flat Bottom Hole Reference Standard for Laminates up to 0.450 Inch
74D111295-1005	Honeycomb Reference Standard With Graphite Epoxy Skin for Sandwich Assemblies Less Than 1 Inch

## Materials Required

## NOTE

Alternate item specifications or part numbers are shown indented.

Specification or Part Number	Nomenclature
ULTRAGEL II MIL-G-81322	Couplant

## Materials Required (Continued)

Specification or Part Number	Nomenclature
MIL-P-83953-2, TYPE 1, CLASS A or B, RED or BLACK	Aircraft Marking Pencil
P-D-680, TYPE 2 D 1153	Dry Cleaning Solvent, Methyl Isobutyl Ketone
CCC-C-46, TYPE 1, CLASS 4	Cleaning Cloth

**WARNING**

Dry cleaning solvent and methyl isobutyl ketone are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

17. **Preparation of Part.** Clean inner and outer surfaces of inspection area with solvent moistened cloth to make sure part is free of contamination or foreign matter.

**WARNING**

Make sure safety precautions have been met for electrical, static, grounding when using ultrasonic equipment near aircraft fuel cells, oxygen systems, electronic systems, and stores (A1-F18AC-PCM-000).

18. **Equipment Setting/Standardization/Setup for Skin to Core Areas.** Do standardization per (WP008 10), except as below:

a. Use two 57A2276 search units and two microdot cables.

b. Use P-1 calibration point on applicable 74D111295 graphite/epoxy skinned honeycomb core sandwich assembly reference standard.

### 19. Inspection Procedure for Skin to Core Areas.

After standardization, inspect skin to core area of applicable door(s) per (WP008 10), except as specified below:

a. Apply couplant to both surfaces of inspection area(s).

b. Make sure initial pulse width does not interfere with location of received response. If required, switch position of search units on microdot cables or use different search unit on receiver cable.

c. If area is covered by aluminum foil tape, make sure foil tape is not cause of defect response.

d. Use ultrasonic pulse-echo per (WP008 13) to determine if suspect areas are result of skin delaminations. Do pulse-echo inspection on both surfaces to help identify location of flaws causing through transmission unbond response.

**20. Equipment Settings/Standardization/Setup for Solid Laminate Area.** Do standardization for laminates less than 0.450 thick per (WP008 11), making sure trailing edge of initial pulse is located at less than 1 large division when 0.100 inch FBH response is 80 to 90 percent CRT height.

### WARNING

Make sure safety precautions have been met for electrical, static, grounding when using ultrasonic equipment near aircraft fuel cells, oxygen systems, electronic systems, and stores (A1-F18AC-PCM-000).

**21. Inspection Procedure for Solid Laminate Areas.** Inspect solid laminate areas per (WP008 11) and following:

a. Apply couplant to solid laminate inspection area where laminate thickness is known.

b. Make sure leading edge of back surface response is located at correct location on horizontal baseline when peak amplitude is 80 to 90 percent CRT height, see figure 4, CRTs 1 through 4.

c. Scan area to be inspected, finger damping back surface response as often, as required, to make sure correct response is being received. Finger damp

by placing couplant on end of finger and touching opposite surface. As finger touches and is then removed from part surface, reflected response on CRT will move up and down as it is damped, indicating good bond.

d. Remove section of foil tape, if required, to damp back surface. Foil tape may not yield correct back surface damping response.

e. For inspection responses in addition to those described in (WP008 11), refer to figure 4.

f. Use pulse-echo mapping techniques per (WP008 11) to determine extent of flaw indication.

### 22. DAMAGE EVALUATION USING MXU-715/E.

Do skin to core and solid laminate damage evaluation per (WP008 10) except as below:

a. Use couplant which will have no effect on patch bonding or edge filling.

b. For local damaged area, scan 2 to 3 inches around visible damage to make sure additional surface defects will be detected.

c. Use radiography to detect subsurface crushed core, laminate cracks, adhesive cracks, and additional adhesive.

d. If determined patch will be bonded to damaged area, scan area not inspected above, which will lie under patch to make sure subsurface damage or additional adhesive does not exist in this area and will not interfere with repair evaluation.

**23. REPAIR EVALUATION USING MXU-715/E.** Do repair evaluation of typical skin to core bonded repair areas (WP008 10) and as below:

a. For edge fill with paste adhesive in solid laminate areas, do standardization of paragraph 18, except as below:

(1) Apply couplant to area next to edge filled repair area.

(2) Position search unit on area next to edge filled repair area, make sure correct back surface response is received. If possible, damp response to make sure correct response is being received, see figure 5, CRT 1.

(3) With back surface response 80 to 90 percent CRT height, move search unit over repair filled area and monitor back surface response.

(4) Back surface response peak amplitude should not change appreciably but intermediate response may be received from laminate/paste adhesive interface, see figure 5, CRT 2.

(5) Scan repair filled area and with aircraft marking pencil mark all areas where back surface response completely disappears. Use pulse-echo mapping techniques (WP008 11) to determine extent of edge filled area flaw.

b. For skin to core areas, do standardization of paragraph 20 and (WP008 10) except only 16 dB GAIN relative to nearby area is allowed, in area where core has been replaced.

### WARNING

Dry cleaning solvent and methyl isobutyl ketone are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

**24. POST INSPECTION CLEANING AND CORROSION CONTROL.** After recording any defects, clean inspection marks and couplant from doors with solvent moistened cloth.

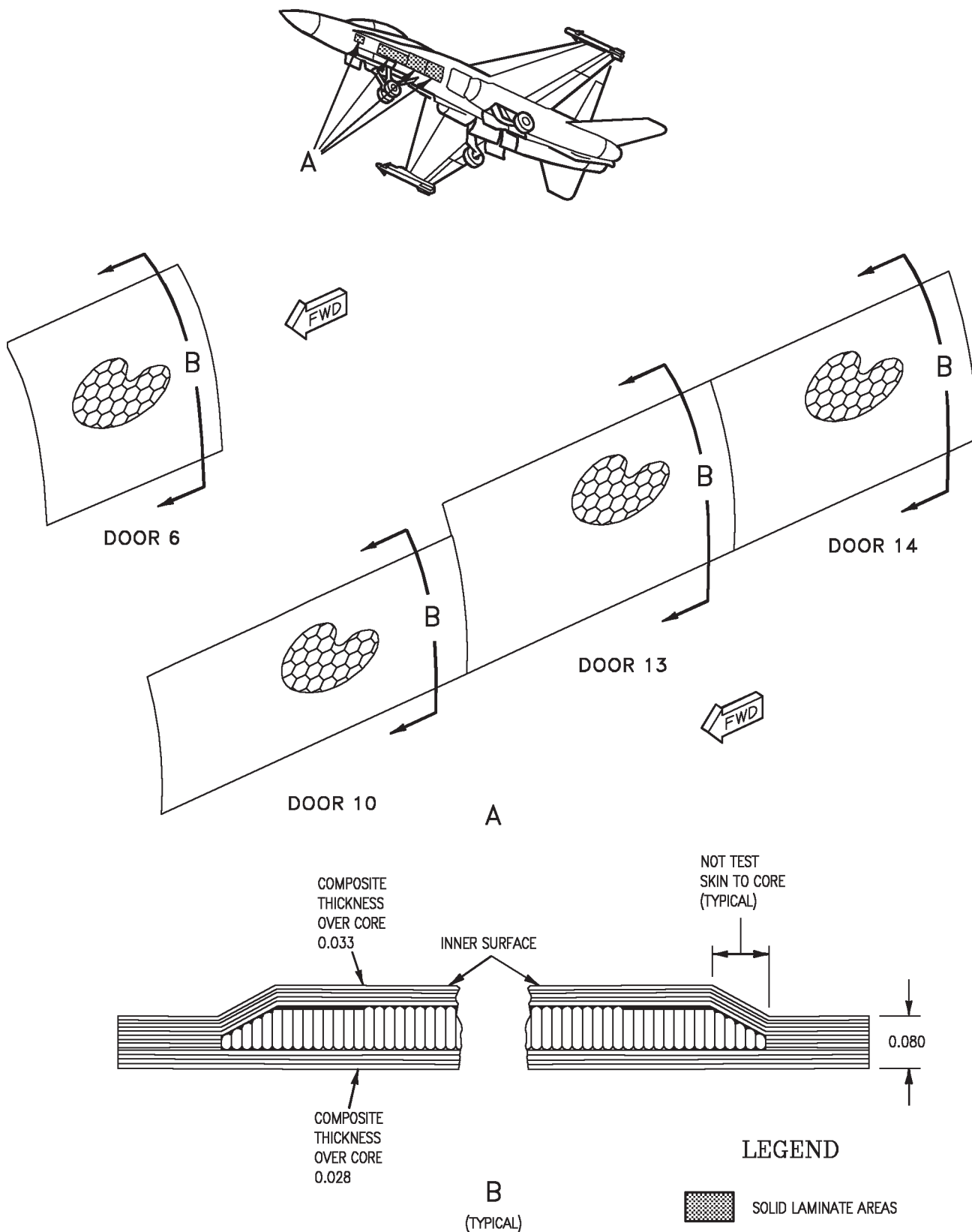
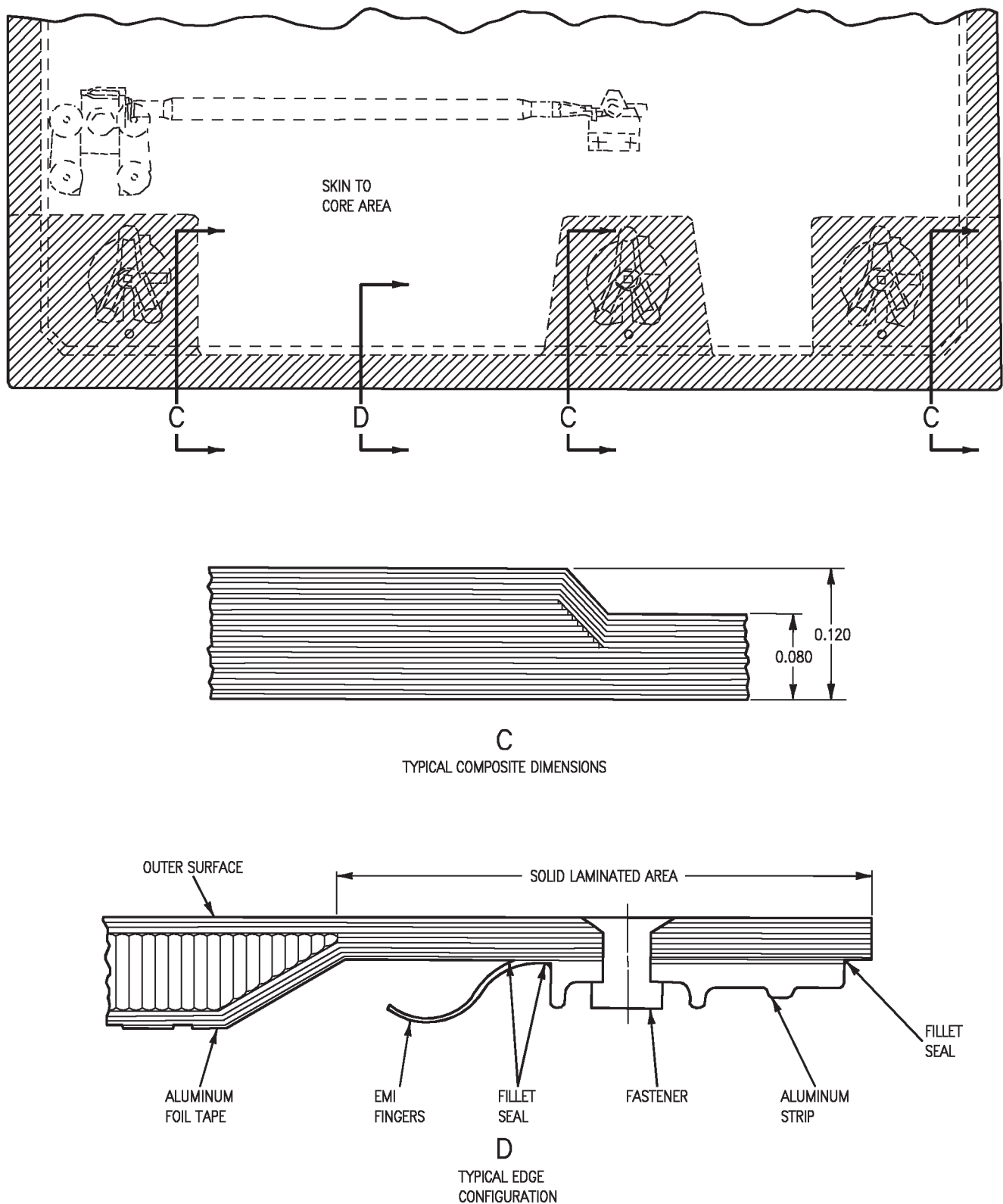
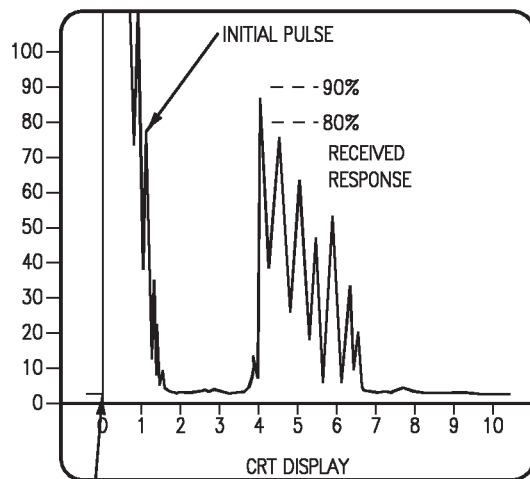
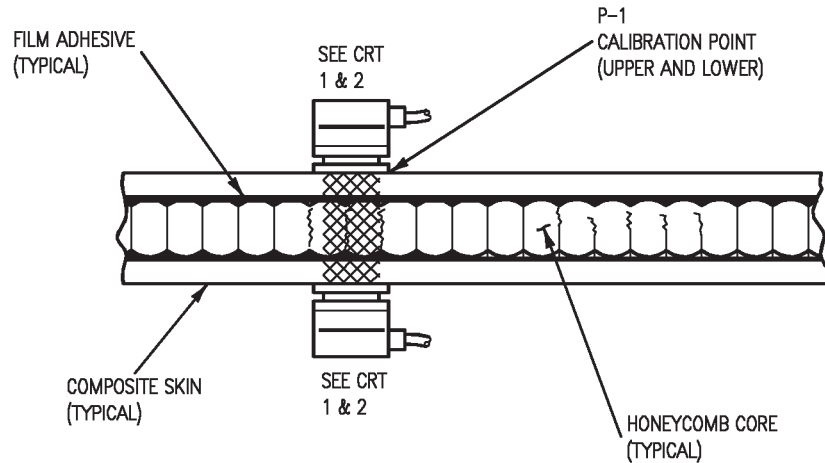


Figure 1. Bonded Honeycomb Core Forward Fuselage Doors, Skin to Core and Solid Laminate Areas (Sheet 1)

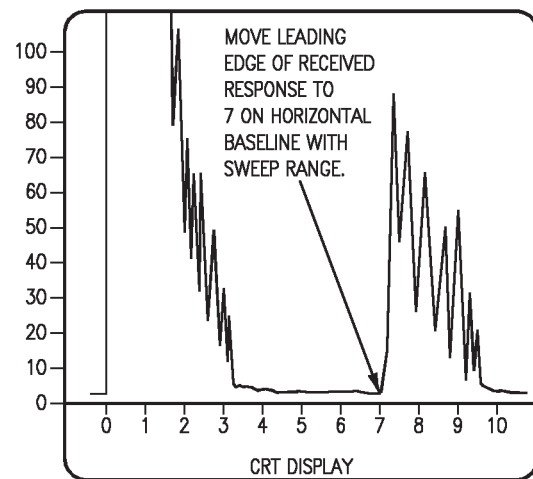


**Figure 1. Bonded Honeycomb Core Forward Fuselage Doors, Skin to Core and Solid Laminate Areas (Sheet 2)**



CRT 1

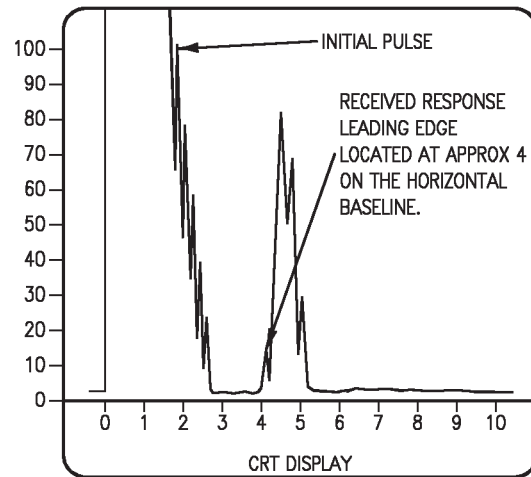
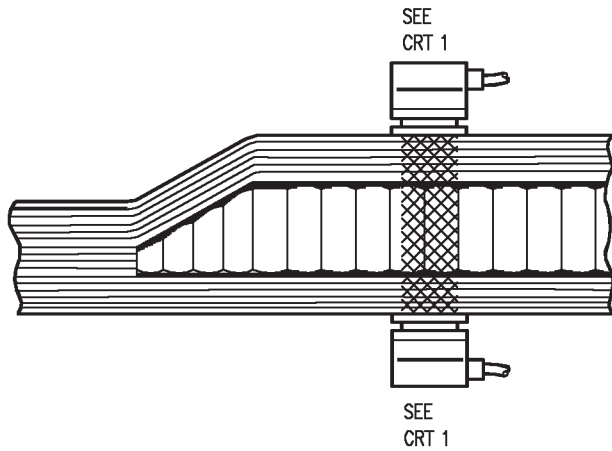
FROM P-1 CALIBRATION POINT



CRT 2

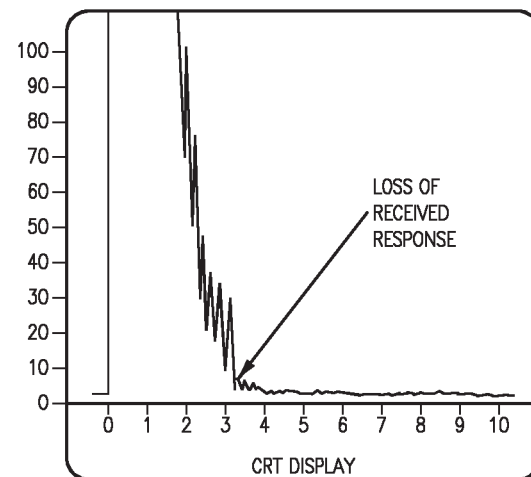
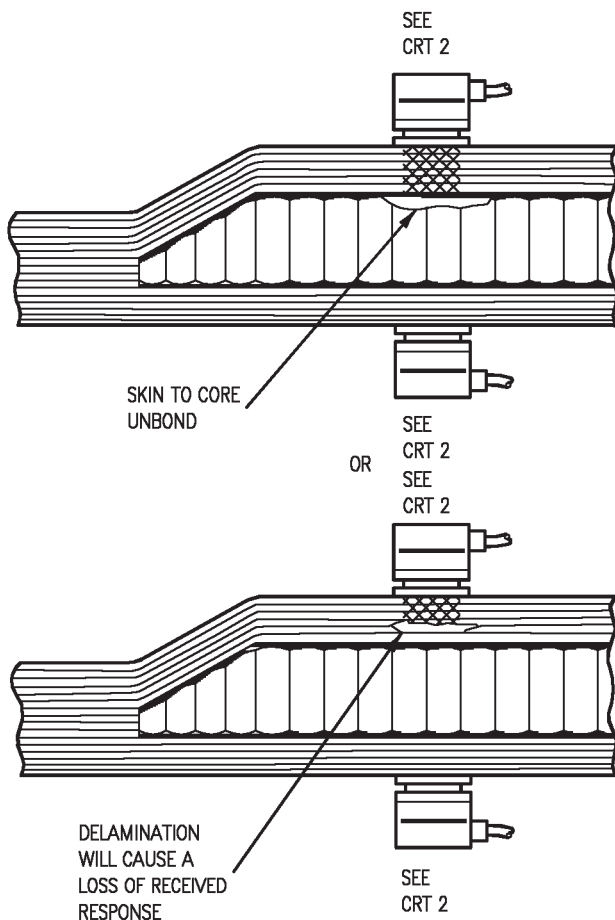
FROM P-1 CALIBRATION POINT

**Figure 2. Standardization on One Half Inch Tall Graphite Epoxy Honeycomb Core Sandwich Assembly Reference Standard**



CRT 1

(TYPICAL) SKIN TO CORE  
GOOD BOND RESPONSE



CRT 2

(TYPICAL) SKIN TO CORE  
UNBOND RESPONSE

Figure 3. Forward Fuselage Doors Honeycomb Core Inspection Responses

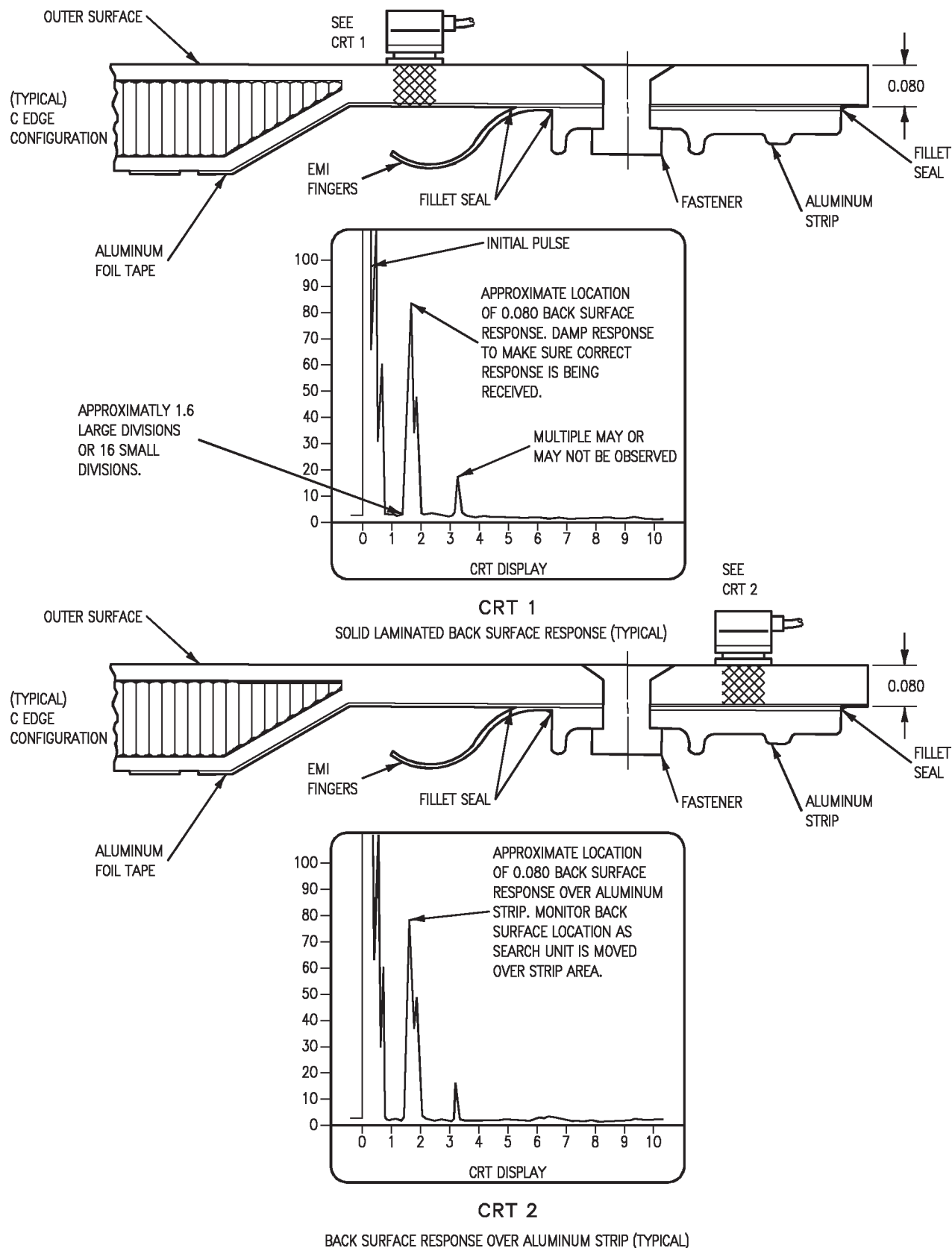
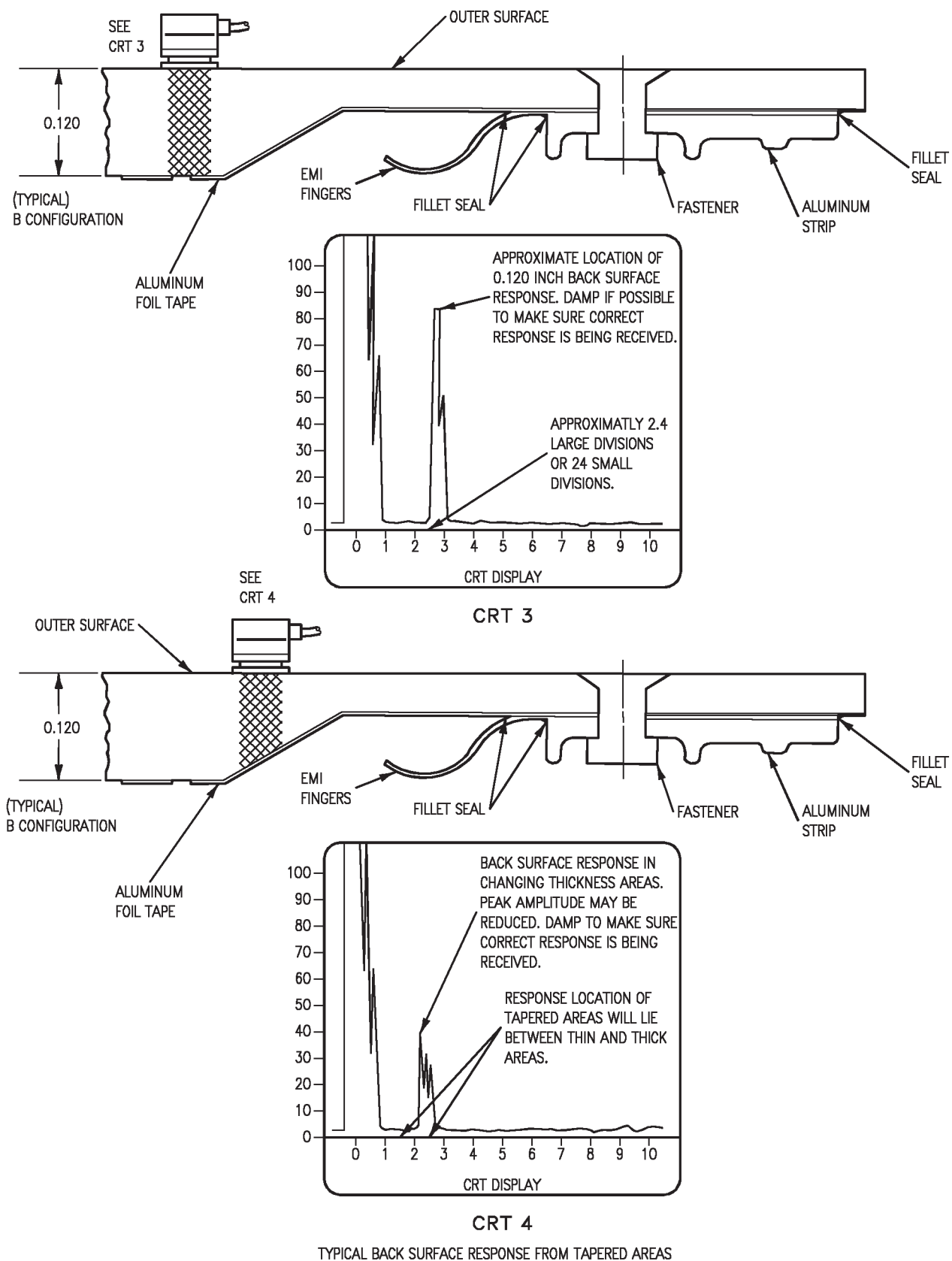
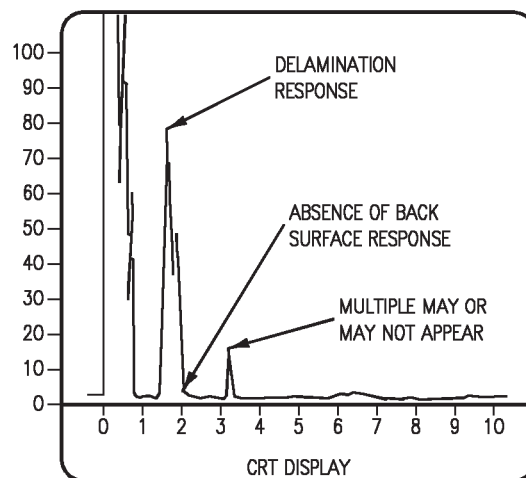
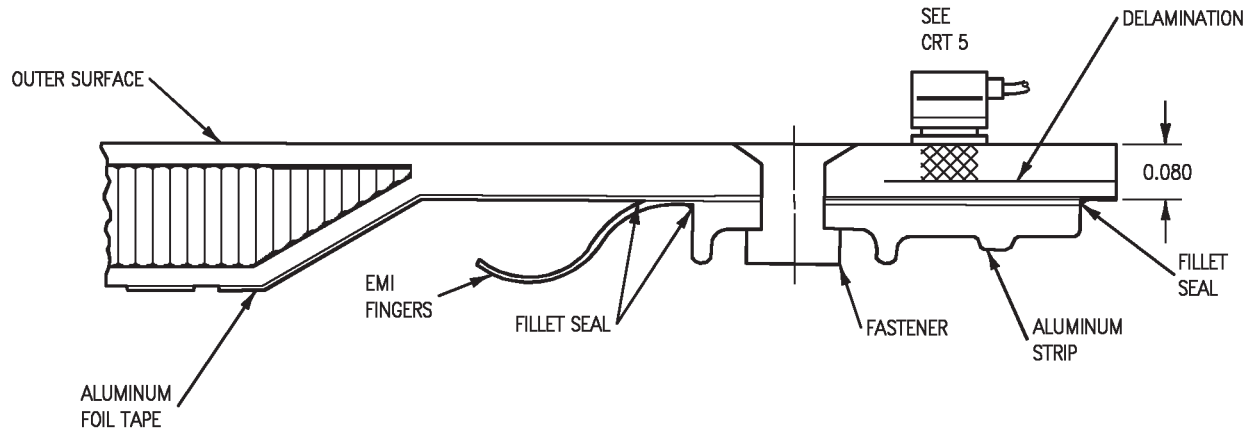


Figure 4. Forward Fuselage Doors Solid Laminate Inspection Responses (Sheet 1)





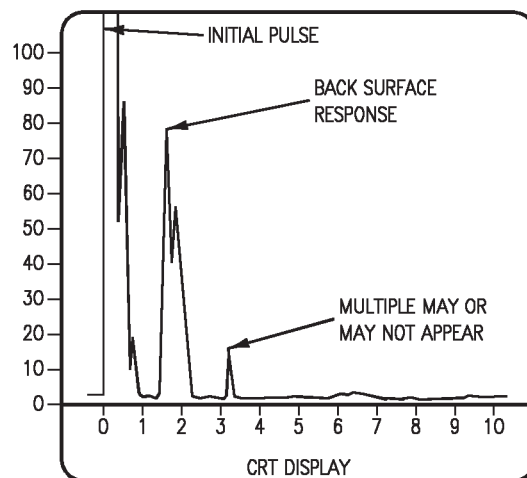
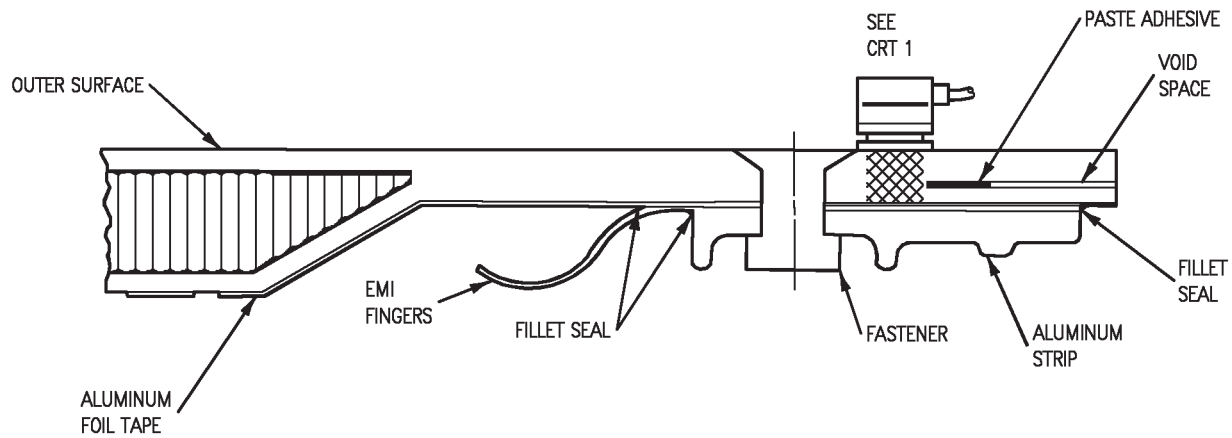
**Figure 4. Forward Fuselage Doors Solid Laminate Inspection Responses (Sheet 2)**



CRT 5

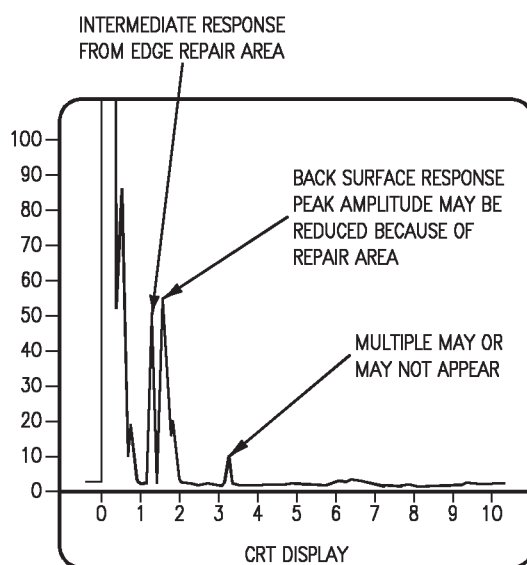
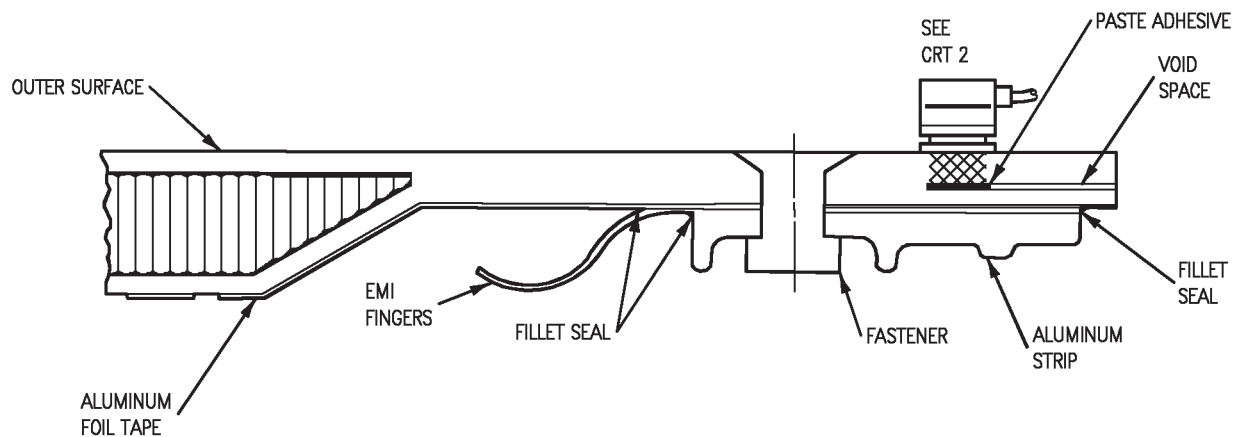
TYPICAL DELAMINATION  
RESPONSE IN 0.080  
SOLID LAMINATE AREA.

Figure 4. Forward Fuselage Doors Solid Laminate Inspection Responses (Sheet 3)



CRT 1

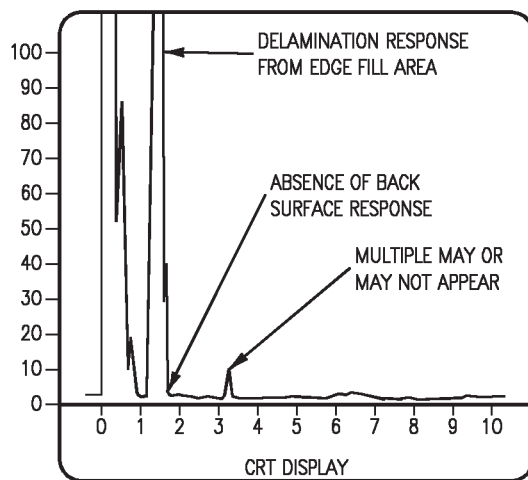
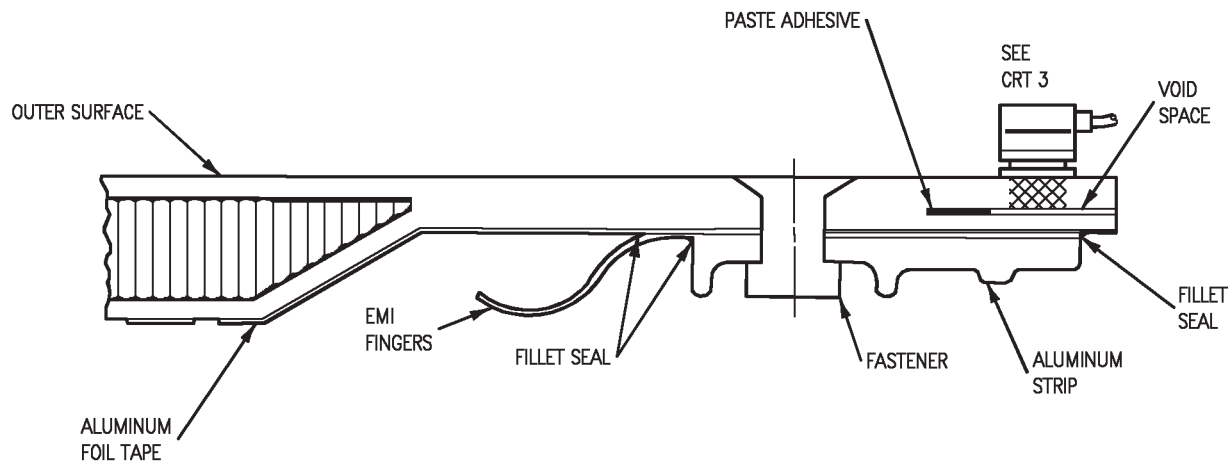
Figure 5. Forward Fuselage Doors Edge Fill Repair Evaluation in Solid Laminate Material (Sheet 1)



CRT 2

TYPICAL GOOD BOND RESPONSE  
AFTER EDGE FILL REPAIR

**Figure 5. Forward Fuselage Doors Edge Fill Repair Evaluation in Solid Laminate Material (Sheet 2)**



CRT 3

TYPICAL DELAMINATION  
RESPONSE FROM BAD  
EDGE FILL AREA

Figure 5. Forward Fuselage Doors Edge Fill Repair Evaluation in Solid Laminate Material  
(Sheet 3)



## INTERMEDIATE MAINTENANCE

## NONDESTRUCTIVE INSPECTION

## FORWARD FUSELAGE LOWER OUTBOARD, Y357.000, AND SIDE LONGERON, Y286.500, INSPECTION

## Reference Material

Naval Aviation Maintenance Program .....	OPNAVINST 4790.2
Structure Repair, Forward Fuselage .....	A1-F18AC-SRM-220
Replacement of Doors 6, 10, 13, 14, 18.....	WP035 01
Aircraft Corrosion Control.....	A1-F18AC-SRM-500
Removal and Cleanup of Corrosion From Structure at Doors 10, 13, and 14.....	WP005 03
Plane Captain Manual .....	A1-F18AC-PCM-000
Nondestructive Inspection.....	A1-F18AC-SRM-300
Eddy Current Surface Inspection of Aluminum Alloys .....	WP007 00
Structure Repair, General Information .....	A1-F18AC-SRM-200
Fasteners .....	WP004 06
Line Maintenance Access Doors.....	A1-F18AC-LMM-010

## Alphabetical Index

Subject	Page No.
Forward Fuselage Lower Outboard and Side Longerons.....	1
Defects .....	1
Post Inspection Cleaning and Corrosion Control.....	3
Primary Inspection Method .....	1
System Securing.....	3

## Record of Applicable Technical Directives

None

**1. FORWARD FUSELAGE LOWER OUTBOARD AND SIDE LONGERON.**

2. Forward fuselage lower outboard Y357.000, and side longeron, Y286.500, are made of 7075-T76 extruded aluminum alloy. Finish system is epoxy primer and tin/zinc arc spray.

3. **DEFECTS.** Inspect for cracks at edges and surface, see figure 1.

4. **PRIMARY INSPECTION METHOD.** Primary inspection method is eddy current.

5. **Personnel Qualifications.** Personnel doing this nondestructive inspection should be qualified and certified to do eddy current inspections per OPNAVINST 4790.2 SERIES, NDI Technicians, NEC 7225/MOS 6044.

6. **Preparation of Aircraft.** No special preparation required.

**7. Access.**

a. Have door 13 removed (A1-F18AC-SRM-220, WP035 01).

b. Have fasteners and hinge half partly removed from longeron, 3 to 4 inches shall give probe clearance (A1-F18AC-SRM-200, WP004 06).

c. Have door 14 opened (A1-F18AC-LMM-010).

d. Have form in place seal and tin/zinc arc spray removed (A1-F18AC-SRM-500, WP005 03).

### Support Equipment Required

Part Number or Type Designation	Nomenclature
ED520	Eddy Current Flaw Detector, Magnatest
WP007 00	EDM Notch Reference Standard, Aluminum
1 RR90F-6-1/2	Right Angle Surface Probe, GK Engineering
MD-BNC	Microdot to BNC Connecting Cable, GK Engineering

### Materials Required

#### NOTE

Alternate item specifications or part numbers are shown indented.

Specification or Part Number	Nomenclature
P-D-680, TYPE 2 D 1153	Dry Cleaning Solvent Methyl Isobutyl Ketone
MIL-P-83953-2, TYPE 1, CLASS A or B, RED or BLACK	Aircraft Marking Pencil
MIL-C-87962, TYPE 1	Cleaning Cloth

#### WARNING

Dry cleaning solvent and methyl Isobutyl ketone are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

8. **Preparation of Part.** Clean inspection area with solvent moistened cloth to make sure inspection areas are free of contamination or foreign material.

#### WARNING

Make sure safety precautions are met for electrical, static, grounding when using eddy current equipment near aircraft fuel cells, oxygen systems, electrical systems, electronic systems, and stores (A1-F18AC-PCM-000).

9. **Equipment Settings/Standardization/Setup.** Do ED520 Flaw Detector Setup (WP007 00) and steps below:

a. Connect 1RR90F-6-1/2 right angle surface probe (probe) to micro dot to BNC connecting cable (connecting cable).

b. Connect connecting cable to eddy current flaw detector (tester).

c. Use 0.030 inch deep by 0.060 inch wide EDM notch on EDM notch reference standard (reference standard, to get 300 microamperes needle deflections on tester).

10. **Inspection Procedure.** Do Inspection Procedure (WP007 00) and below:

a. Position probe on longeron.

b. Use BALANCE to set meter needle at 250 microamperes.

c. Scan surfaces by moving probe at constant rate, no greater than needed to get flaw response on reference standard.

d. Scan parallel and perpendicular directions to length of longerons as shown in figure 1.



e. Index 1/2 diameter of probe and 90 degrees to scan direction after each scan.

f. Sharp down scale meter needle deflection exceeding 200 microamperes is indication of fatigue cracks.

g. Mark defects with aircraft marking pencil and record.

## 11. POST INSPECTION CLEANING AND CORROSION CONTROL.

a. Have tin/zinc arc spray reapplied (A1-F18AC-SRM-500, WP005 03).

b. Have form in place seal reapplied (A1-F18AC-SRM-500, WP005 03).

## 12. SYSTEM SECURING.

a. Have fasteners replaced in hinge half (A1-F18AC-SRM-200, WP004 06).

b. Have door 13 reinstalled (A1-F18AC-LMM-010).

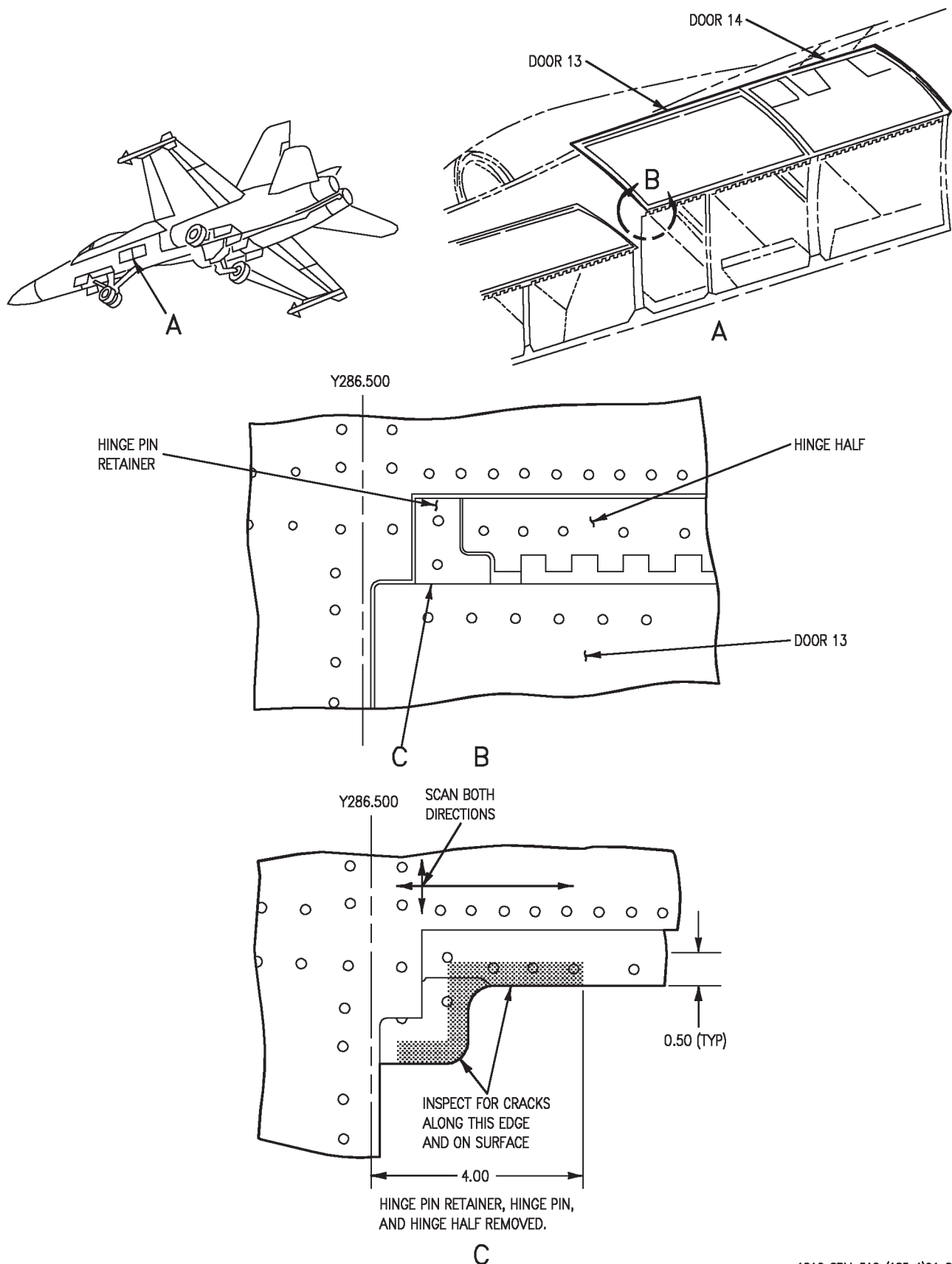


Figure 1. Forward Fuselage Lower Outboard and Side Longeron Inspection (Sheet 1)

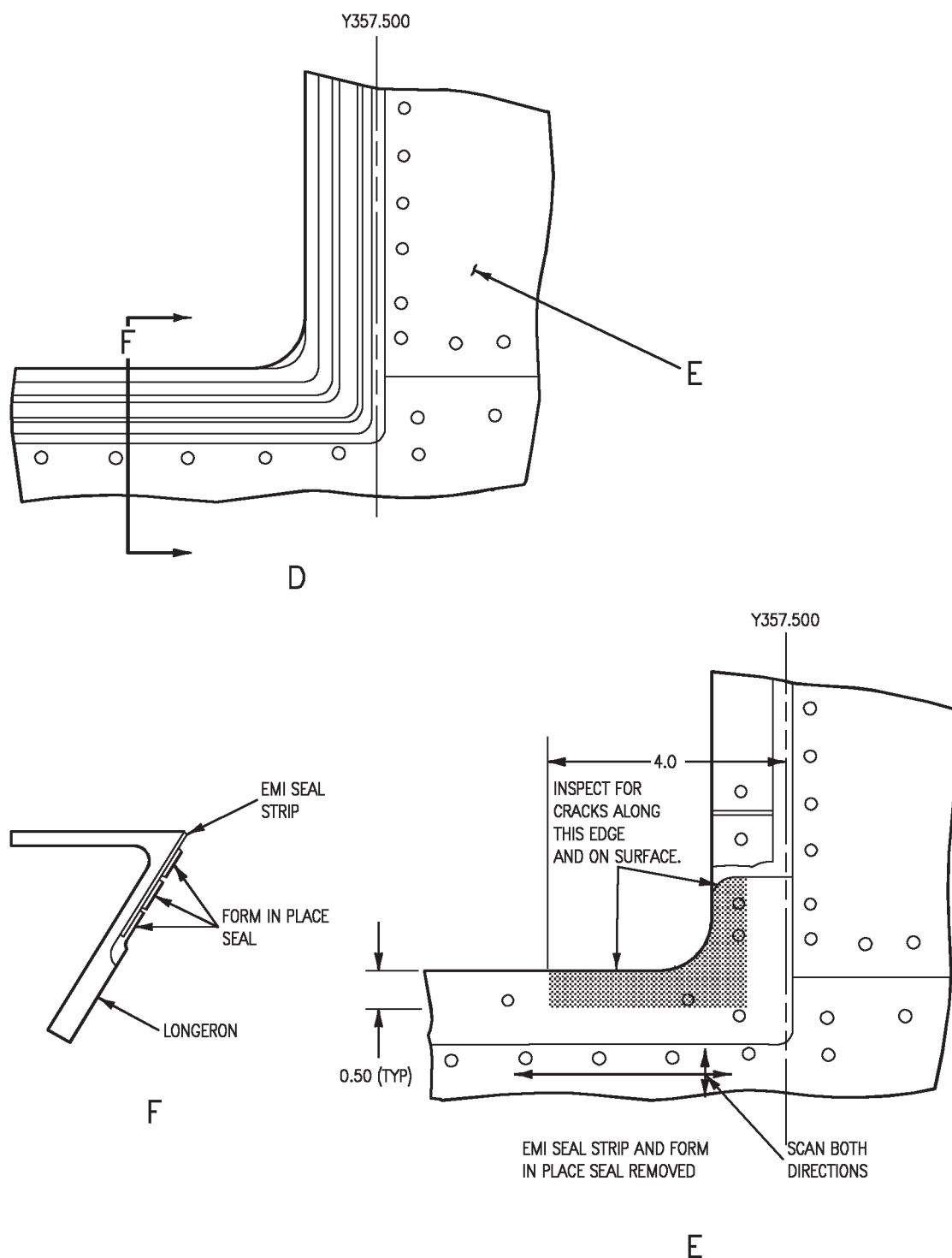


Figure 1. Forward Fuselage Lower Outboard and Slide Longeron Inspection (Sheet 2)



## INTERMEDIATE MAINTENANCE

## NONDESTRUCTIVE INSPECTION

## FORWARD FUSELAGE BONDED HONEYCOMB DOORS

## WATER IN HONEYCOMB

DOOR 6 PART NO. 74A315068

DOOR 10 PART NO. 74A315069

DOOR 13 PART NO. 74A315071

DOOR 14 PART NO. 74A315073

## Reference Material

Naval Aviation Maintenance Program .....	OPNAVINST 4790.2
Nondestructive Inspection Methods .....	NAVAIR 01-1A-16
Nondestructive Inspection.....	A1-F18AC-SRM-300
Radiographic Method.....	WP005 00
General Information .....	WP003 00

## Alphabetical Index

Subject	Page No.
Forward Fuselage Doors.....	1
Defects .....	1
Primary Inspection Method .....	1

## Record of Applicable Technical Directives

None

## 1. FORWARD FUSELAGE DOORS.

2. Forward fuselage doors, see figure 1, are bonded honeycomb assemblies. Honeycomb cores are 0.125, hexagonal cell, 5056 aluminum alloy. Skins are graphite epoxy with one ply fiberglass overlay on inner surface. Surface finish is epoxy primer and polyurethane coating.

3. **DEFECTS.** Inspect for water trapped in honeycomb core. Example of defect is contained in WP003 00.

4. **PRIMARY INSPECTION METHOD.** Primary inspection method is radiographic.

5. **Personnel Qualifications.** Personnel doing this nondestructive inspection should be qualified and certified to do radiographic inspections per OPNAVINST 4790.2 SERIES, NDI Technicians, NEC 7225/MOS 6044.

6. **Preparation of Aircraft.** No special preparation required.

7. **Access.** No special access required.

8. **Preparation of Part.** No special preparation required.

### Support Equipment Required

Part Number or Type Designation	Nomenclature
314X	Film Identification Set
MIL-STD-453	Penetrameter Set
GXR7-6B	X-ray Apparatus, Portable
072000	X-ray Film Processor

### Materials Required

#### NOTE

Alternate item specifications or part numbers are shown indented.

Specification or Part Number	Nomenclature
INDUSTREX M FILM CODE M2	Radiographic Film, X-ray Film 14x17
INDUSTREXAA FILM CODEAA2 14x17	Radiographic Film, X-ray Film 14x17
MIL-P-83953-2, TYPE 1, CLASS A or B, RED or BLACK	Aircraft Marking Pencil
A-A-883, TYPE 1	Pressure Sensitive Tape, Masking Tape

#### WARNING

#### HIGH RADIATION

Make sure applicable safety precautions in WP005 00 and NAVAIR 01-1A-16 are complied with. Failure to comply may result in injury to personnel.

### 9. Equipment Settings/Standardization/Setup.

Set X-ray unit per data contained in technique chart, see figure 1.

### 10. Inspection Procedure.

#### NOTE

X-ray film for all shots are double loaded. AA film is located next to part and both films are exposed simultaneously.

a. Door 6, locate films 1 and 2 for shot 1. Film should be taped to moldline of door with identification markers taped to source side of door.

b. Locate source to aiming point for shot 1. Source should be normal to aiming point and located on inner side of door.

c. Expose films 1 and 2 using technique chart settings for shot 1. Remove exposed film.

d. Door 10, repeat steps a through c for films 3 through 7 and shot 2.

e. Door 13, repeat steps a through c for films 8 through 15 and shot 3.

f. Door 14, repeat steps a through c for films 16 through 21 and shot 4.

g. Process exposed film. Interpret radiographs for water trapped in honeycomb core (WP005 00).

h. Mark defect(s) using aircraft marking pencil.

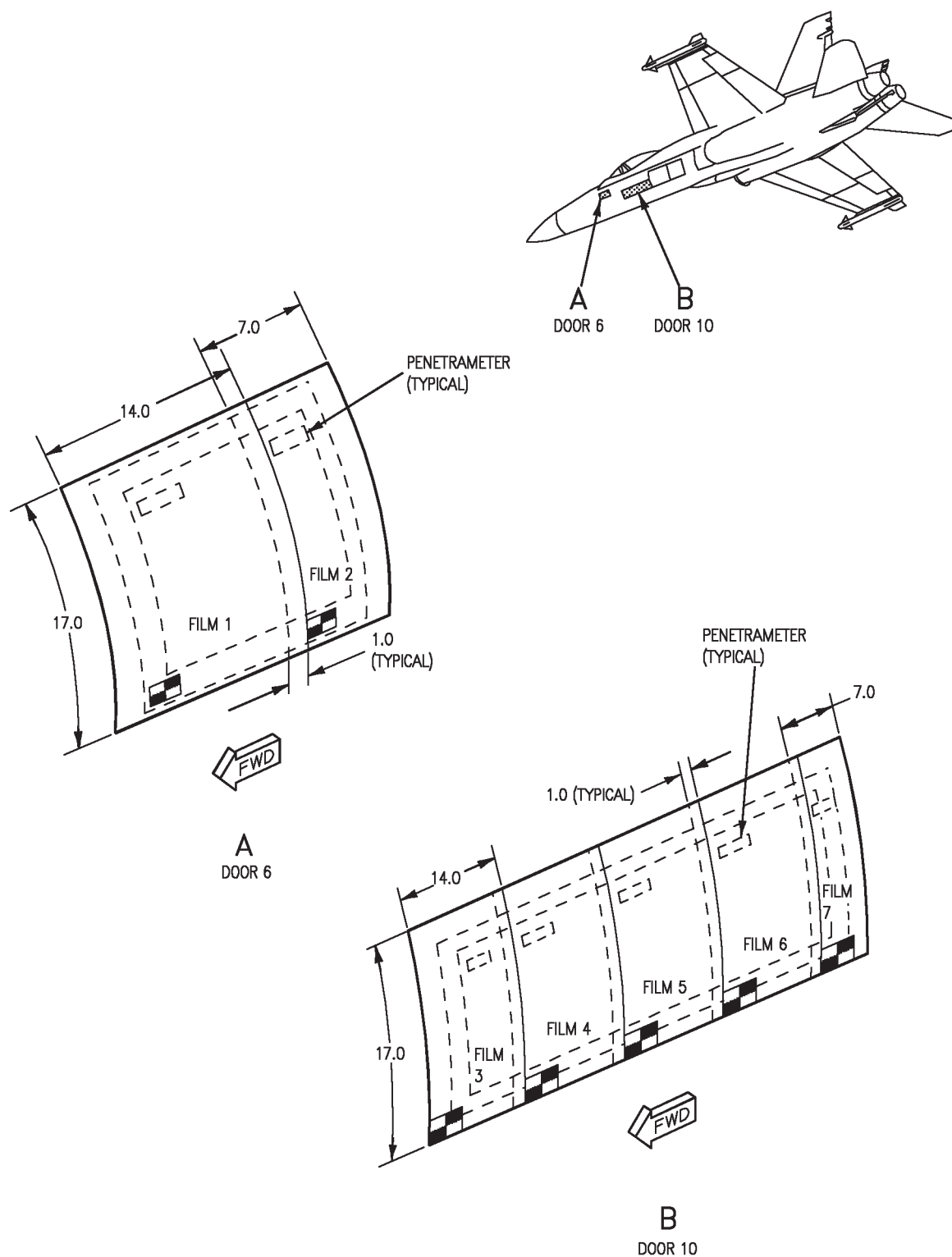


Figure 1. Bonded Honeycomb Doors, Water in Honeycomb (Sheet 1)

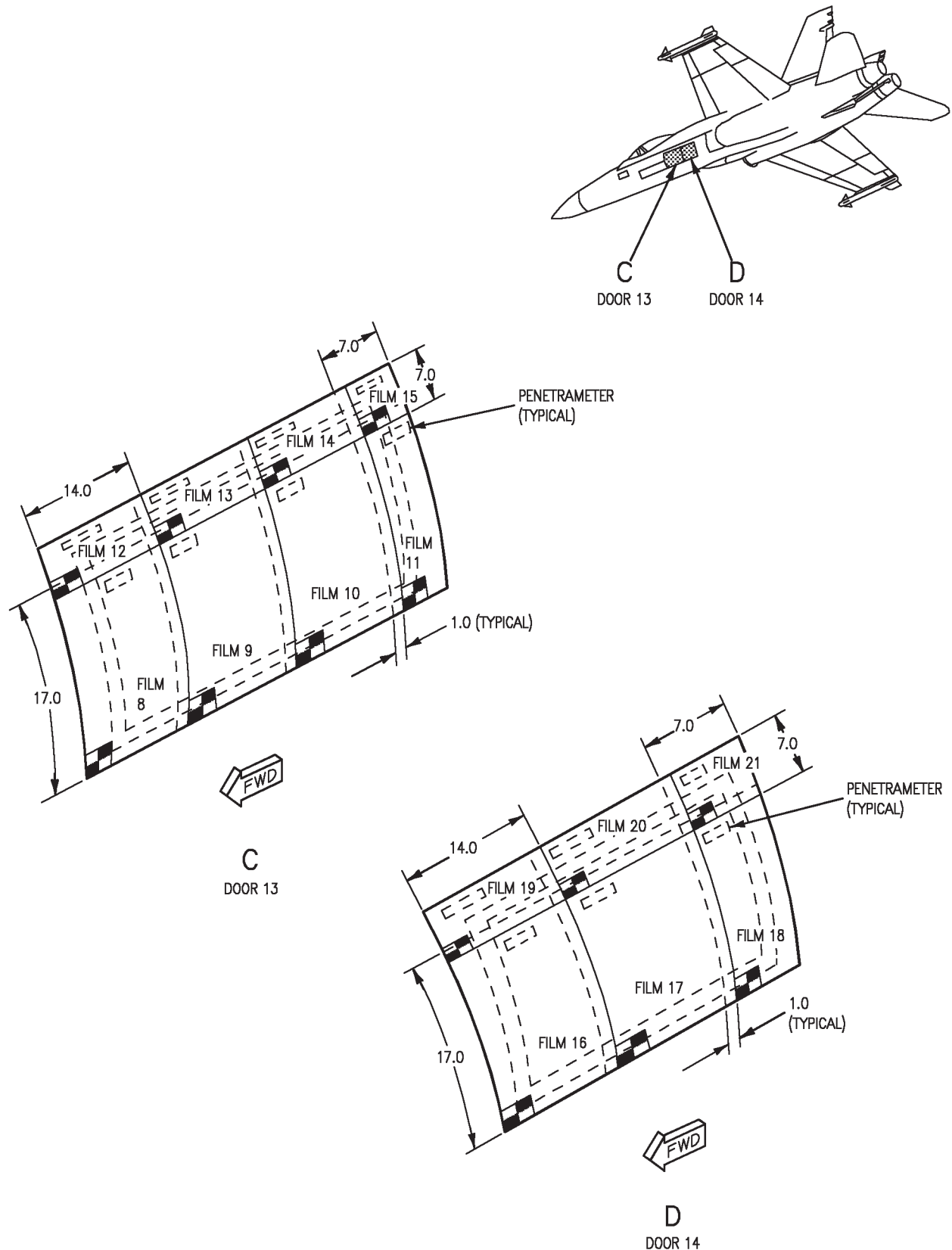
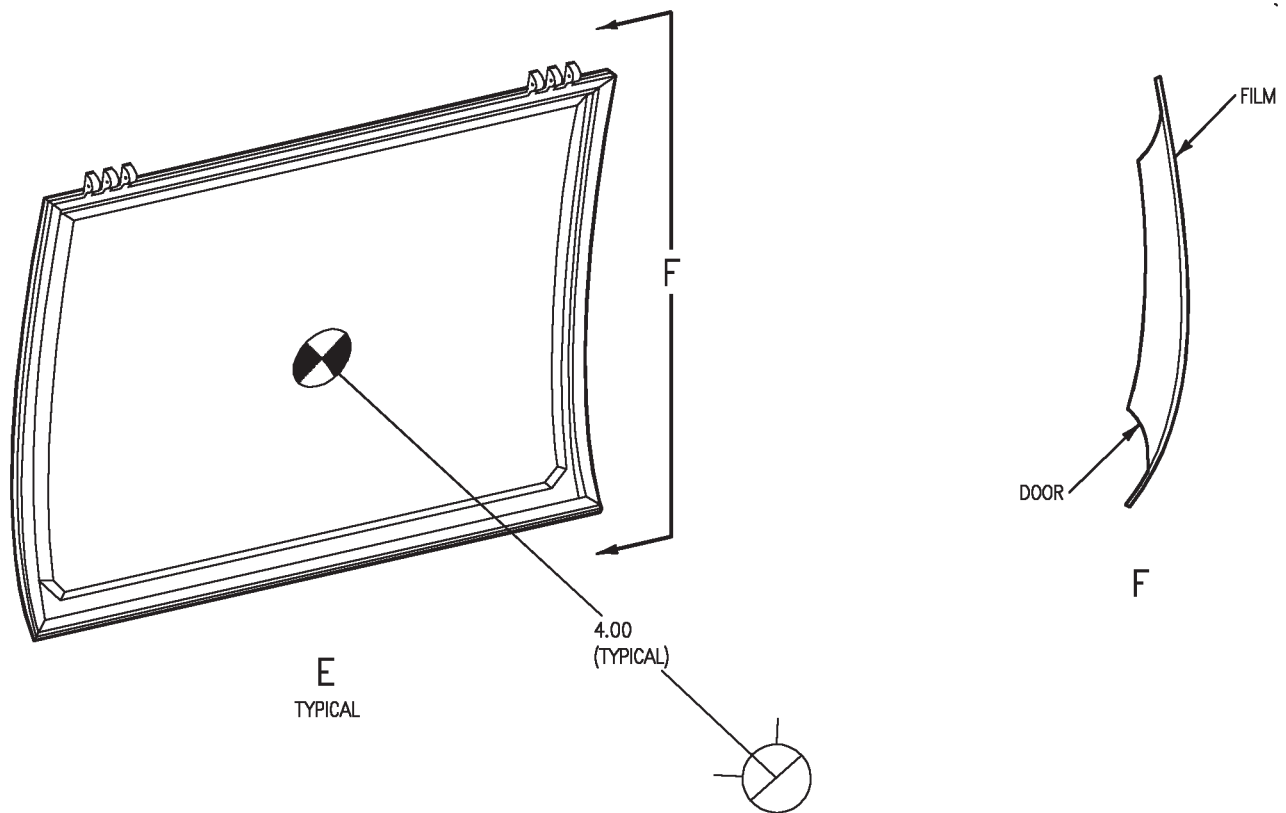


Figure 1. Bonded Honeycomb Doors, Water in Honeycomb (Sheet 2)





TECHNIQUE CHART								
SHOT	FILM SIZE <span style="border: 1px solid black; padding: 0 2px;">2</span>	FILM GROUP	BACK SCREEN	PENETRATOR MIL-STD-453	mA	kVP	EXPOSURE (MINUTES)	<span style="border: 1px solid black; padding: 0 2px;">1</span> DENSITY
1	14 X 17	AA AND M	0.010 Pb	0.25 AL	5.0	30	1	1.0-3.5
	7 X 17	AA AND M	0.010 Pb	0.25 AL	5.0	30	1	1.0-3.5
2	14 X 17	AA AND M	0.010 Pb	0.25 AL	5.0	30	1	1.0-3.5
	7 X 17	AA AND M	0.010 Pb	0.25 AL	5.0	30	1	1.0-3.5
3	14 X 17	AA AND M	0.010 Pb	0.25 AL	5.0	30	1	1.0-3.5
	7 X 17	AA AND M	0.010 Pb	0.25 AL	5.0	30	1	1.0-3.5
4	7 X 14	AA AND M	0.010 Pb	0.25 AL	5.0	30	1	1.0-3.5
	7 X 7	AA AND M	0.010 Pb	0.25 AL	5.0	30	1	1.0-3.5
	14 X 17	AA AND M	0.010 Pb	0.25 AL	5.0	30	1	1.0-3.5
	7 X 17	AA AND M	0.010 Pb	0.25 AL	5.0	30	1	1.0-3.5
	7 X 14	AA AND M	0.010 Pb	0.25 AL	5.0	30	1	1.0-3.5
	7 X 7	AA AND M	0.010 Pb	0.25 AL	5.0	30	1	1.0-3.5
LEGEND								
<span style="border: 1px solid black; padding: 0 2px;">1</span> H AND D DENSITY UNITS.								
<span style="border: 1px solid black; padding: 0 2px;">2</span> FOR FILM SIZES OTHER THAN 14 X 17, CUT AND BAGGED 7 X 7, 7 X 14, AND 7 X 17 FILM MADE FROM 14 X 17 FILM IS ALLOWED.								

Figure 1. Bonded Honeycomb Doors, Water in Honeycomb (Sheet 3)



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**INTERMEDIATE MAINTENANCE****NONDESTRUCTIVE INSPECTION****INNER WING SKIN FIXED TRAILING EDGE PANELS AND ACCESS COVERS****DELAMINATIONS****DOOR 78 PART NO. 74A110965 (L/R)****DOOR 79 PART NO. 74A110955 (L/R) EFFECTIVITY: 161353 THRU 163175****DOOR 79 PART NO. 74A110956 (L/R) EFFECTIVITY: 163427 AND UP****DOOR 82 PART NO. 74A110966 (L/R)****LOWER INBOARD SKIN ASSEMBLY PART NO. 74A110954 (L/R)**

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**Reference Material**

Plane Captain Manual .....	A1-F18AC-PCM-000
Naval Aviation Maintenance Program .....	OPNAVINST 4790.2
Nondestructive Inspection.....	A1-F18AC-SRM-300
General Information .....	WP003 00
Pulse-Echo, Longitudinal Wave Contact Without Delay Line, for Composite Laminate Material .....	WP008 02
Pulse-Echo, Longitudinal Wave Contact With Delay Line, for Composite Laminate Material .....	WP008 03
Pulse-Echo Longitudinal, Contact, Without Delay Line, For Composite Laminate Materials.....	WP008 11
Pulse-Echo Longitudinal, Contact, With Delay Line, For Composite Laminate Materials.....	WP008 12

**Alphabetical Index**

<b>Subject</b>	<b>Page No.</b>
Inner Wing Skin Fixed Trailing Edge Panel and Access Covers.....	2
Defects .....	2
Post Inspection Cleaning and Corrosion Control.....	4
Primary Inspection Method .....	2
Ultrasonic Method Using C-398 Ultrasonic Flaw Detector .....	2
Ultrasonic Method Using MXU-715/E Ultrasonic Flaw Detector .....	3

**Record of Applicable Technical Directives**

None

## 1. INNER WING SKIN FIXED TRAILING EDGE PANEL AND ACCESS COVERS.

2. See figure 1. Inner wing skin fixed trailing edge panels and access covers are solid graphite epoxy laminate material. Surface finish is epoxy primer and polyurethane coatings.

3. **DEFECTS.** Inspect for delaminations, see figure 1. Example of delamination that may develop is contained in (WP003 00).

4. **PRIMARY INSPECTION METHOD.** Primary inspection method is ultrasonic.

5. **Personnel Qualifications.** Personnel doing this nondestructive inspection should be qualified and certified to do ultrasonic inspections per OPNAVINST 4790.2 SERIES, NDI Technicians, NEC 7225/MOS 6044.

6. **Preparation of Aircraft.** No special preparation required.

7. **Access.** No special access required.

## 8. ULTRASONIC METHOD USING C-398 ULTRASONIC FLAW DETECTOR.

### Support Equipment Required

#### NOTE

Alternate item type designations or part numbers are listed in parentheses.

Part Number or Type Designation	Nomenclature
C-398 (303B)	Ultrasonic Flow Detector
57A2271 or EQUIVALENT	Microdot to BNC Connecting Cable 2 Req'd.
57A2214 or EQUIVALENT	0°, 0.25 Dia., 5 MHz, Contact, Delay Line, Search Unit
GD0504	0°, 0.25 Dia., 5 MHz, Contact, Delay Line, Search Unit
74D110175-1001	Graphite Epoxy Reference Standard Set Containing the Following:

### Support Equipment Required (Continued)

#### NOTE

Alternate item type designations or part numbers are listed in parentheses.

Part Number or Type Designation	Nomenclature
74D111295-1009	Graphite Epoxy Flat Bottom Hole Reference Standard for Laminates up to 0.450 Inch

### Materials Required

Specification or Part Number	Nomenclature
ULTRAGEL II	Couplant
MIL-P-83953-2, TYPE 1, CLASS A or B, RED or BLACK	Aircraft Marking Pencil
P-D-680, TYPE 2 D 1153	Dry Cleaning Solvent Methyl Isobutyl Ketone
CCC-C-46, TYPE I Class 4	Cleaning Cloth

### WARNING

Dry cleaning solvent and methyl isobutyl ketone are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

9. **Preparation of Part.** Clean inspection area with solvent moistened cloth to make sure part is free of contamination or foreign material.

10. **Equipment Settings/Standardization/Setup.** Do equipment standardization/Setup per (WP008 02), except as specified below:

a. Set up for laminates less than 0.450 inch thick before inspection.

b. Make sure trailing edge of initial pulse is located at less than 1 large division when 0.100 inch thick FBH response is 80 to 90 percent CRT height.

c. Use 74D111295-1009 reference standard.

#### 11. Inspection Procedure for Solid Laminate

**Areas.** After standardizing, do pulse-echo inspection of solid laminate areas shown in figure 1 per (WP008 02) and the following:

a. Position search unit on inspection area where laminate thickness is known. Additional thickness information is shown in figures 6 through 9.

b. Make sure leading edge of back surface response is at correct location on horizontal base line when peak amplitude is 80 to 90 percent CRT height.

c. Map and identify flaws located near surface by doing pulse-echo contact delay line inspection per (WP008 03).

d. Do paragraph 18.

### WARNING

Make sure safety precautions have been met for electrical, static, grounding when using ultrasonic equipment near aircraft fuel cells, oxygen systems, electrical systems, electronic systems, and stores (A1-F18AC-PCM-000).

#### 12. Equipment Settings/Standardization/Setup.

Do Equipment Settings/Standardization/Setup For Pulse-Echo, Longitudinal Wave Contact, Without Delay Line, For Composite Laminate Material up to 0.450 Inch (WP008 02).

#### 13. Inspection Procedure.

a. Do Inspection of Composite Laminate Material Using Pulse-Echo, Longitudinal Wave Contact, Without Delay Line, (WP008 02).

(1) Determine laminate thickness from figure 1.

(2) Typical acceptable responses are shown in figures 2 through 5.

(3) After flaw outline of defect(s) has been made, it may be required to determine depth of flaw below inspection surface.

(4) When applicable, estimate these depths with setup used to inspect laminate.

(5) For flaws closer to surface additional near surface resolution may be gained by using delay line search unit.

(6) For mapping and determining flaw depth near inspection surface, use Equipment Settings/Standardization/Setup, Inspection of Composite Laminate Material Using Pulse-Echo, Longitudinal Wave Contact, With Delay Line, and Mapping (WP008 03).

b. Do paragraph 15.

#### 14. ULTRASONIC METHOD USING MXU-715/E ULTRASONIC FLAW DETECTOR.

### Support Equipment Required

#### NOTE

Alternate item type designation or part numbers are listed in parentheses.

Part Number or Type Designation	Nomenclature
1642AS100-1	Ultrasonic Flaw Detector, MXU-715/E, Magnaflux
57A2271 or EQUIVALENT	Microdot to BNC Connecting Cable 2 Req'd.
57A2214 or EQUIVALENT	0°, 0.25 Dia., 5 MHz, Contact, Delay Line, Search Unit
GD0504	0°, 0.25 Dia., 5 MHz, Contact, Delay Line, Search Unit
74D110175-1001	Graphite Epoxy Reference Standard Set Containing the Following:

### Support Equipment Required (Continued)

Part Number or Type Designation	Nomenclature
74D111295-1009	Graphite Epoxy Flat Bottom Hole Reference Standard for Laminates up to 0.450 Inch

### Materials Required

Specification or Part Number	Nomenclature
ULTRAGEL II	Couplant
MIL-P-83953-2, TYPE 1, CLASS A or B, RED or BLACK	Aircraft Marking Pencil
P-D-680, TYPE 2 D 1153	Dry Cleaning Solvent Methyl Isobutyl Ketone
CCC-C-46, TYPE I Class 4	Cleaning Cloth

#### WARNING

Dry cleaning solvent and methyl isobutyl ketone are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

15. **Preparation of Part.** Clean inspection area with solvent moistened cloth to make sure part is free of contamination or foreign material.

16. **Equipment Settings/Standardization/Setup.** Do equipment standardization/Setup per (WP008 11), except as specified below:

a. Set up for laminates less than 0.450 inch thick before inspection.

b. Make sure trailing edge of initial pulse is located at less than 1 large division when 0.100 inch thick FBH response is 80 to 90 percent CRT height.

c. Use 74D111295-1009 reference standard.

#### 17. Inspection Procedure for Solid Laminate

**Areas.** After standardizing, do pulse-echo inspection of solid laminate areas shown in figure 1 per (WP008 11) and the following:

a. Position search unit on inspection area where laminate thickness is known. Additional thickness information is shown in figures 6 through 9.

b. Make sure leading edge of back surface response is at correct location on horizontal base line when peak amplitude is 80 to 90 percent CRT height.

c. Map and identify flaws located near surface by doing pulse-echo contact delay line inspection per (WP008 12).

#### WARNING

Dry cleaning solvent and methyl isobutyl ketone are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

18. **POST INSPECTION CLEANING AND CORROSION CONTROL.** Clean inspection area(s) with solvent moistened cloth to make sure inspection area(s) is free of contamination or foreign material.

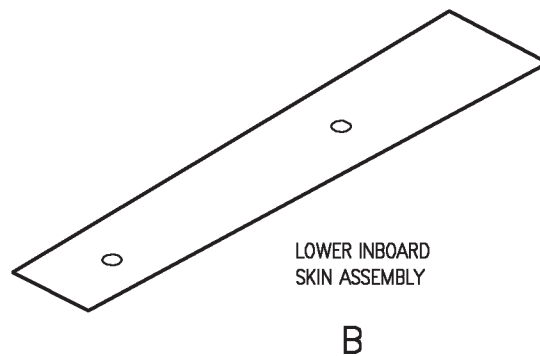
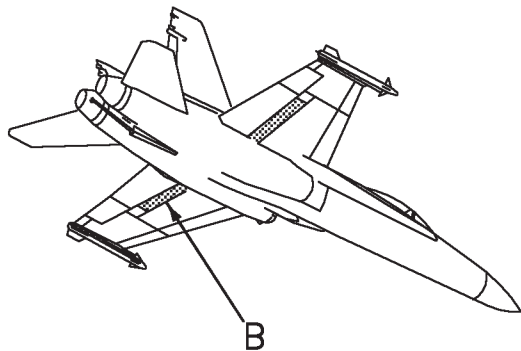
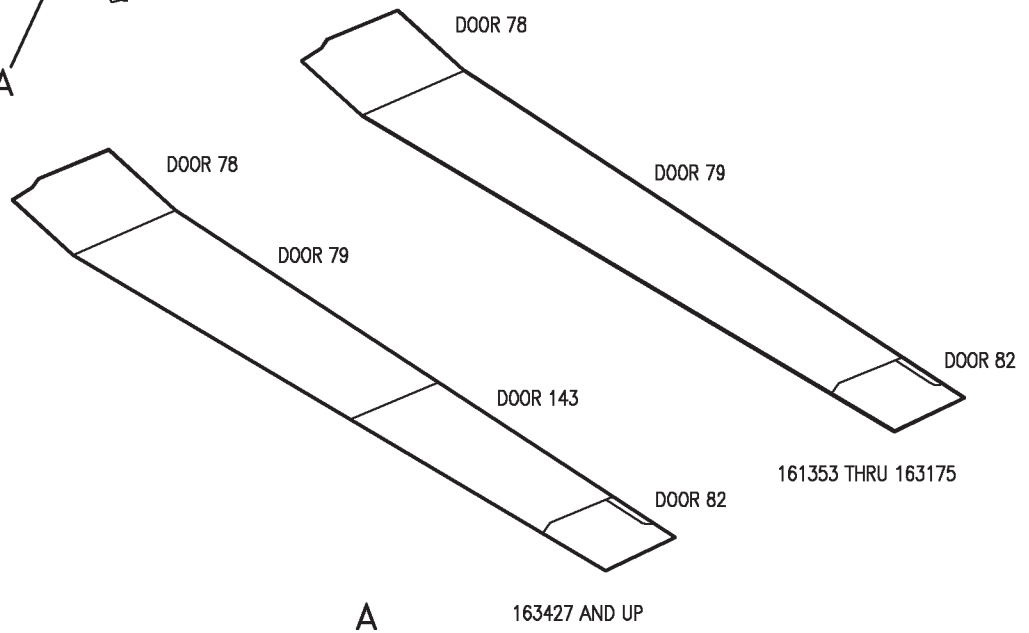
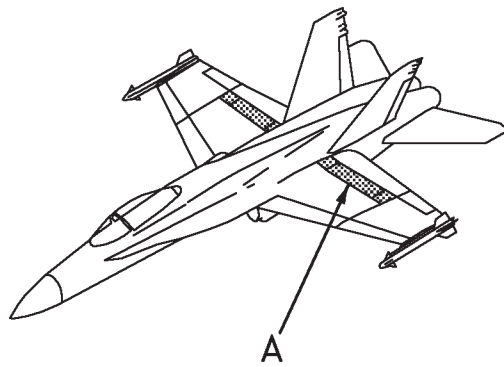


Figure 1. Skin and Access Covers (Sheet 1)

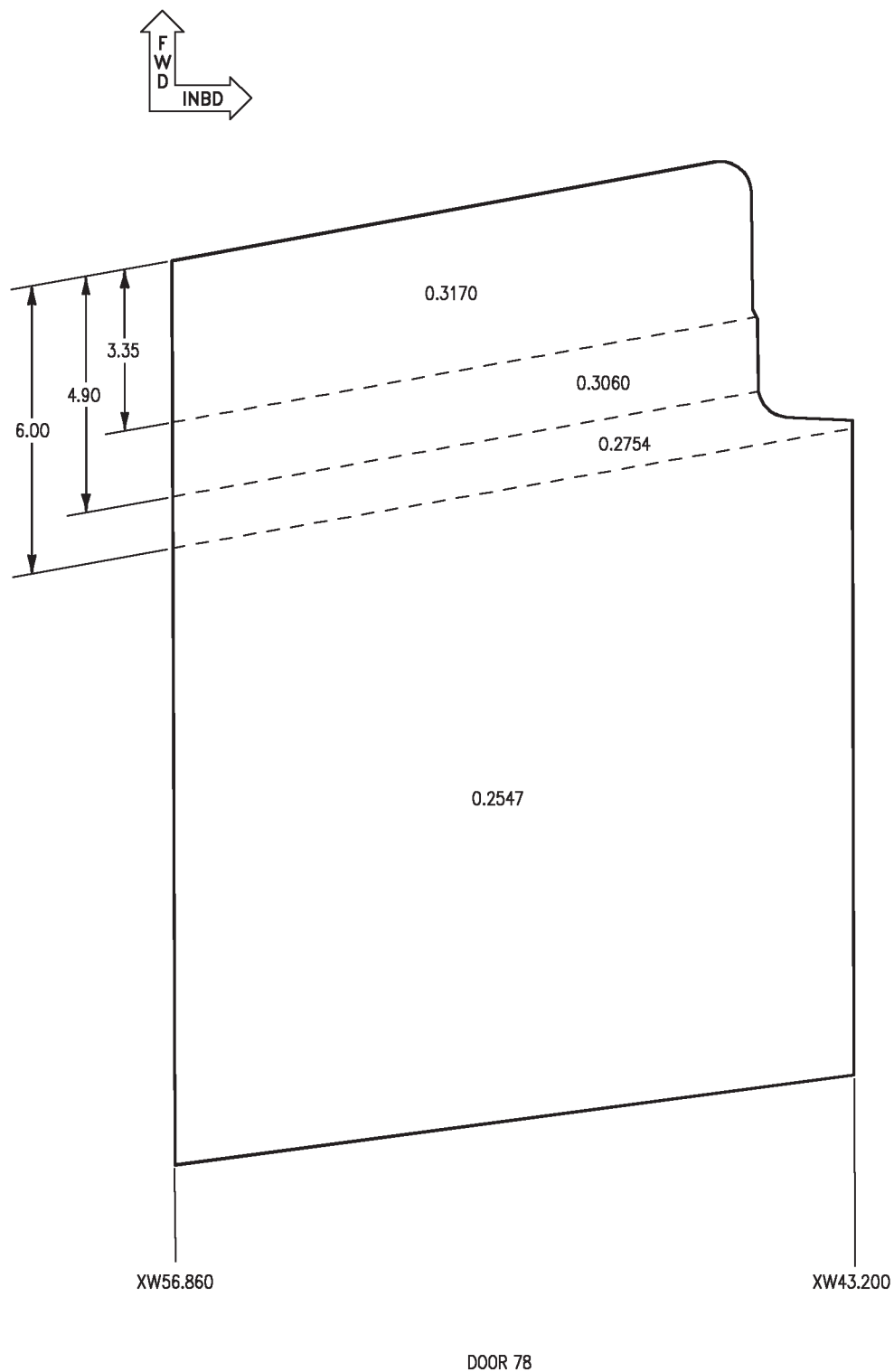
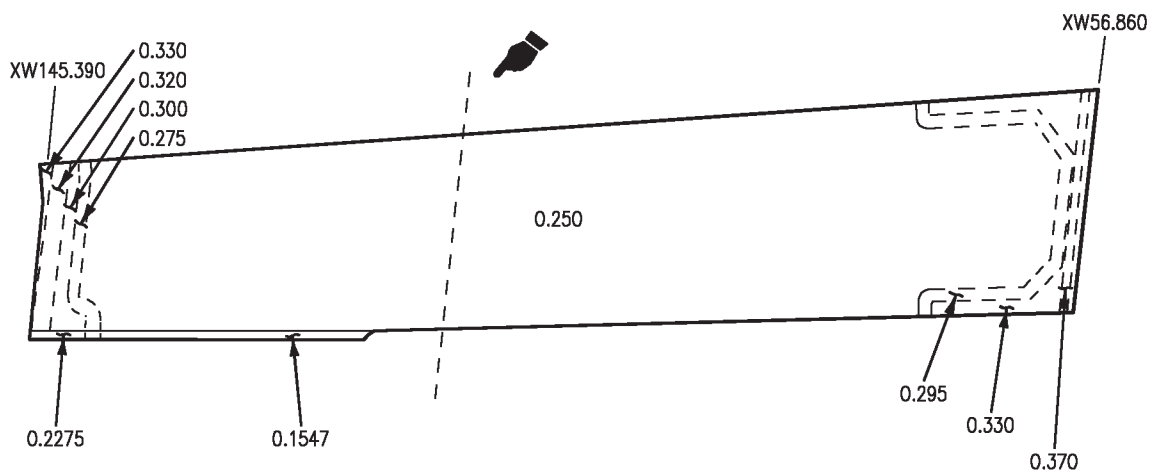
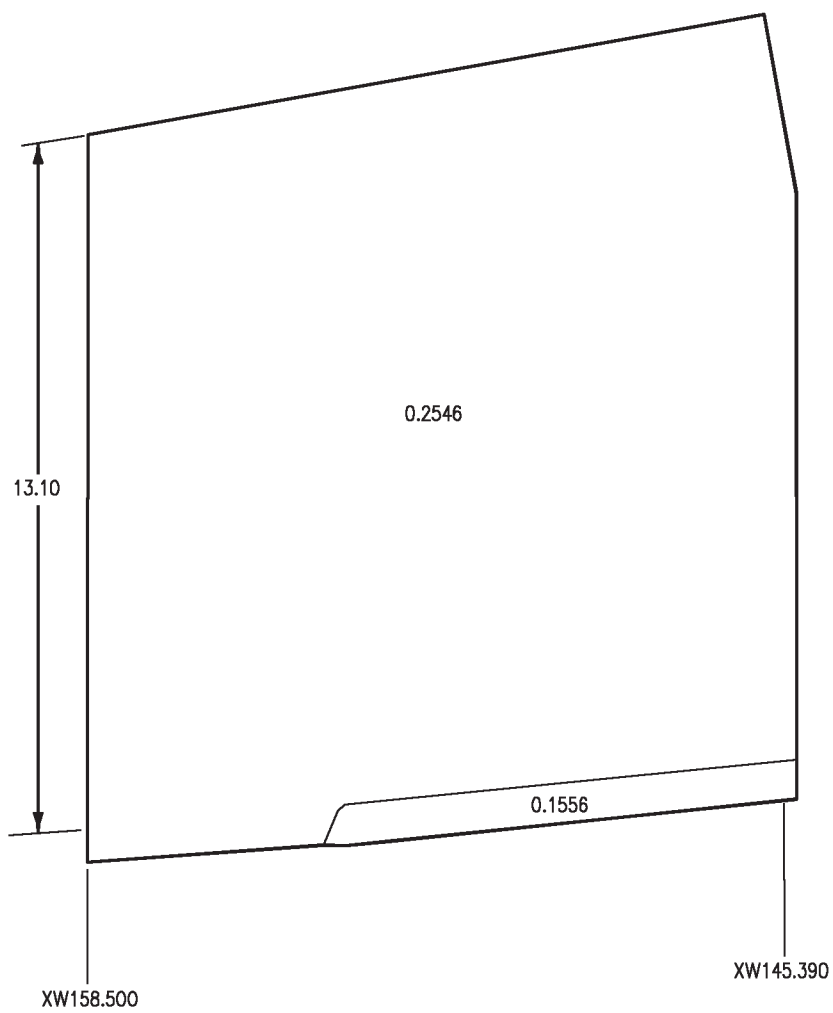


Figure 1. Skin and Access Covers (Sheet 2)





DOOR 79 161353 THRU 163175.  
DOOR 79/143 163427 AND UP.



DOOR 82

Figure 1. Skin and Access Covers (Sheet 3)

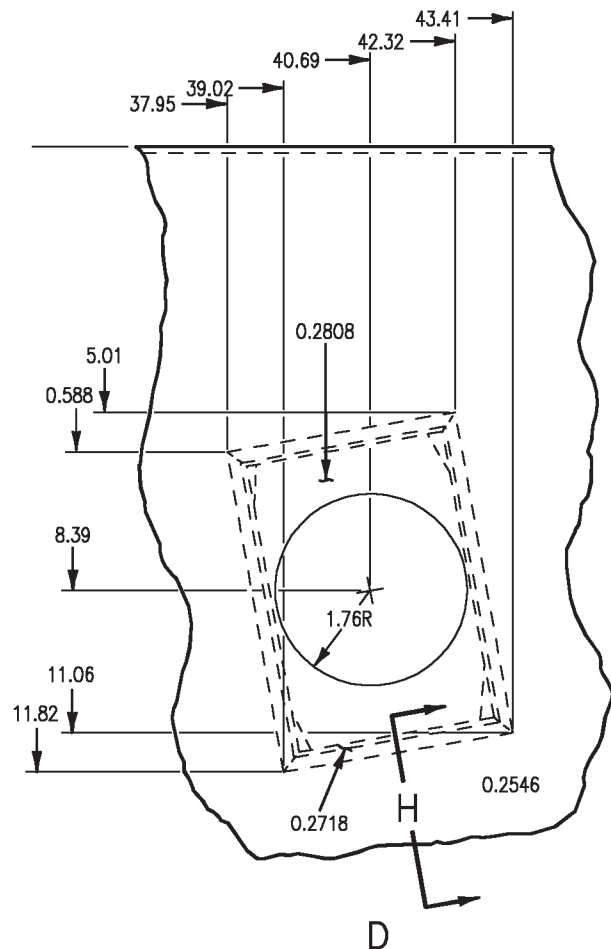
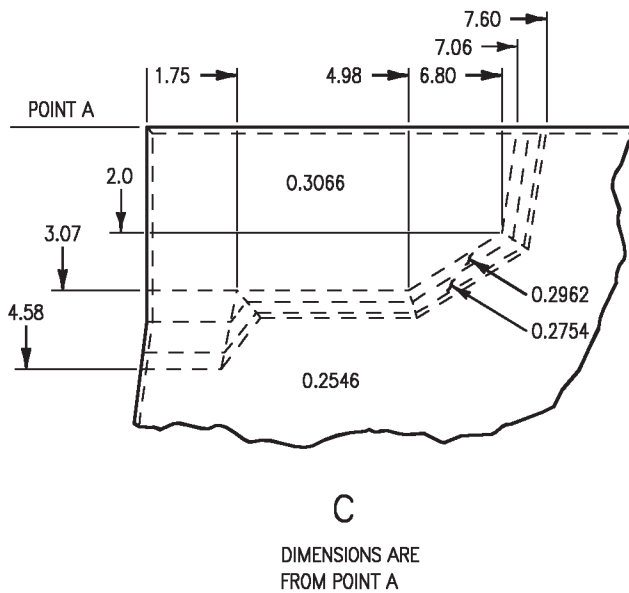
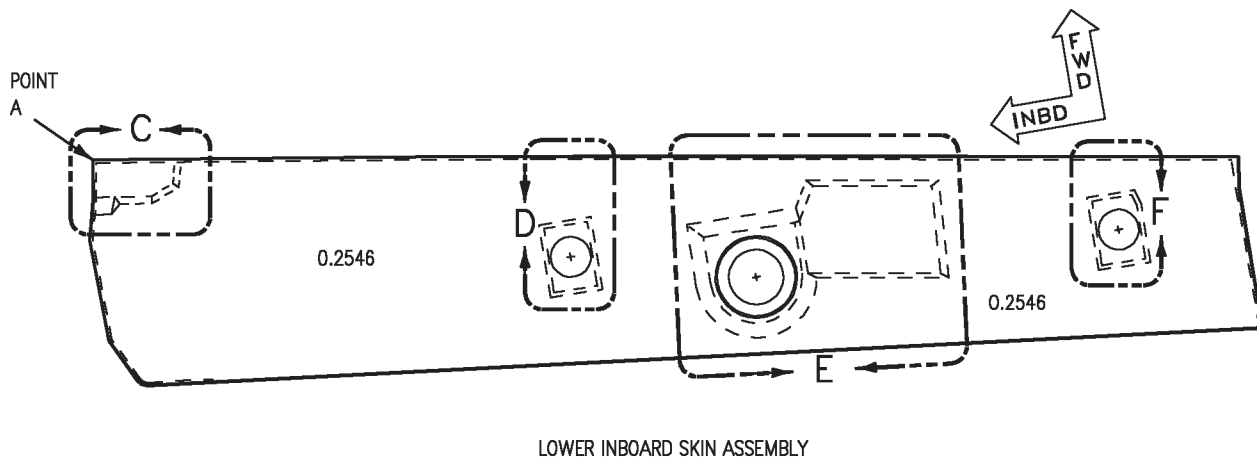


Figure 1. Skin and Access Covers (Sheet 4)

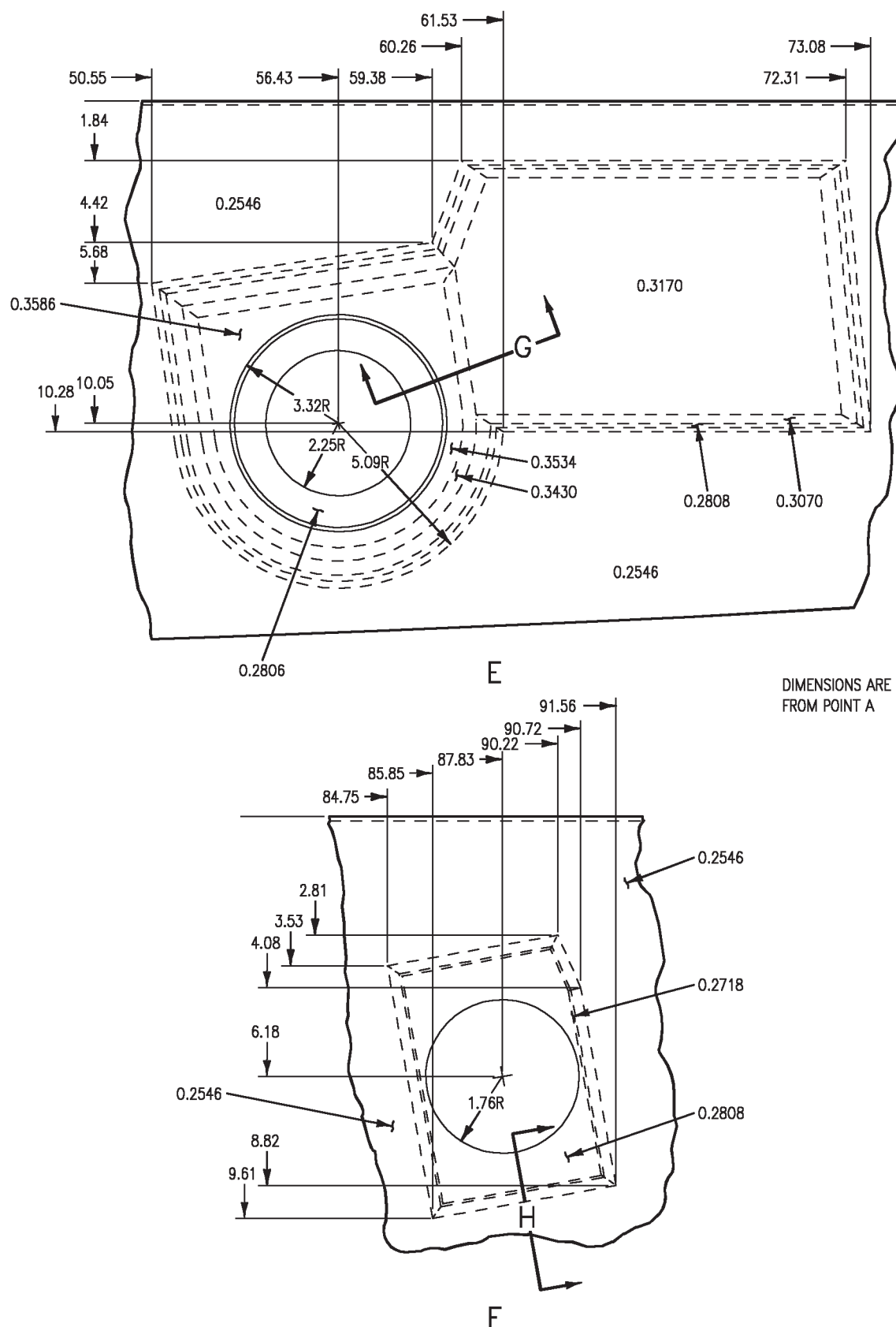
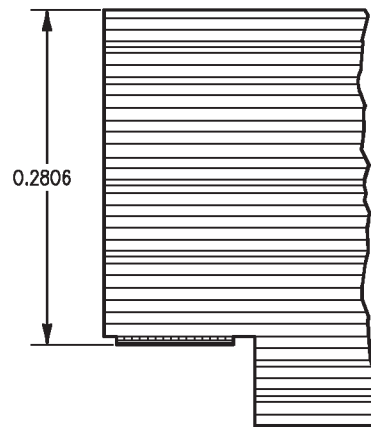
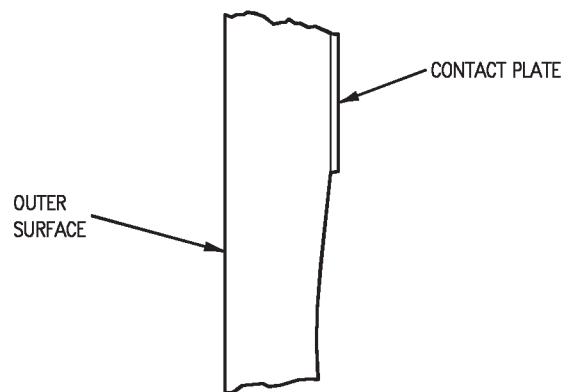


Figure 1. Skin and Access Covers (Sheet 5)



G



H

Figure 1. Skin and Access Covers (Sheet 2)

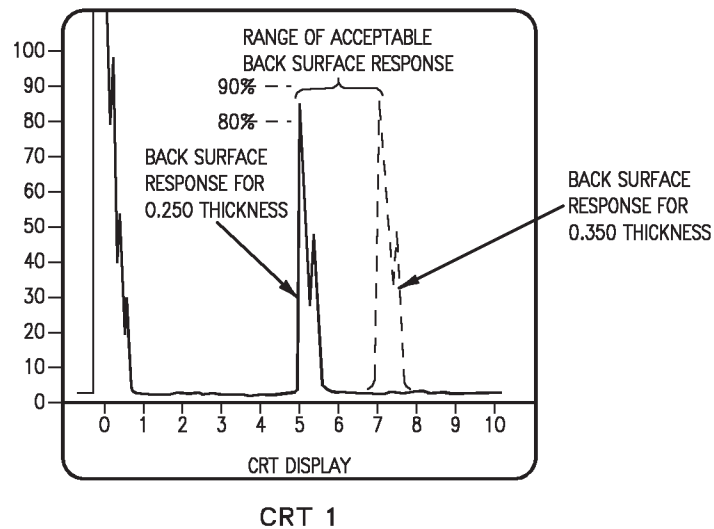
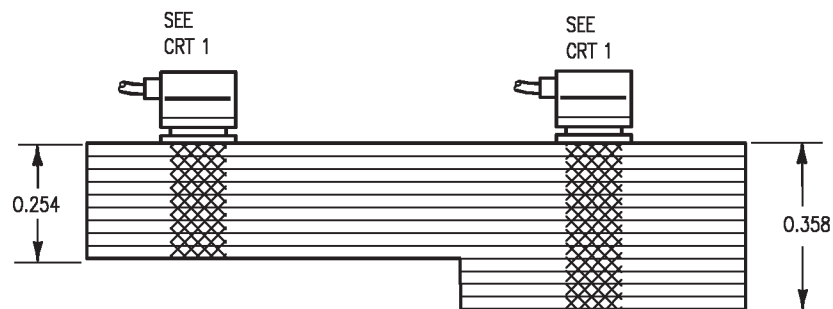


Figure 2. Typical Thickness and Ultrasonic Responses For Lower Inboard Skin Assembly, 74A110954

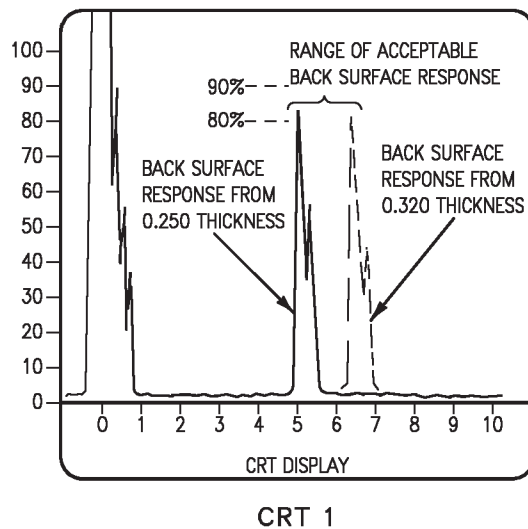
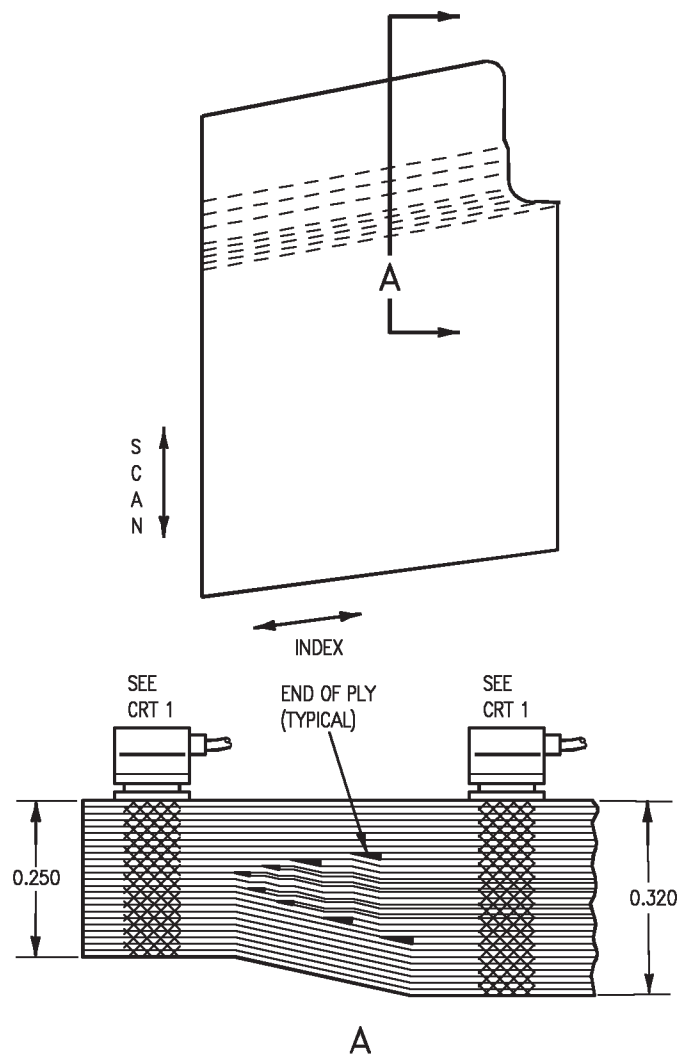


Figure 3. Typical Thicknesses and Ultrasonic Responses For Door 78

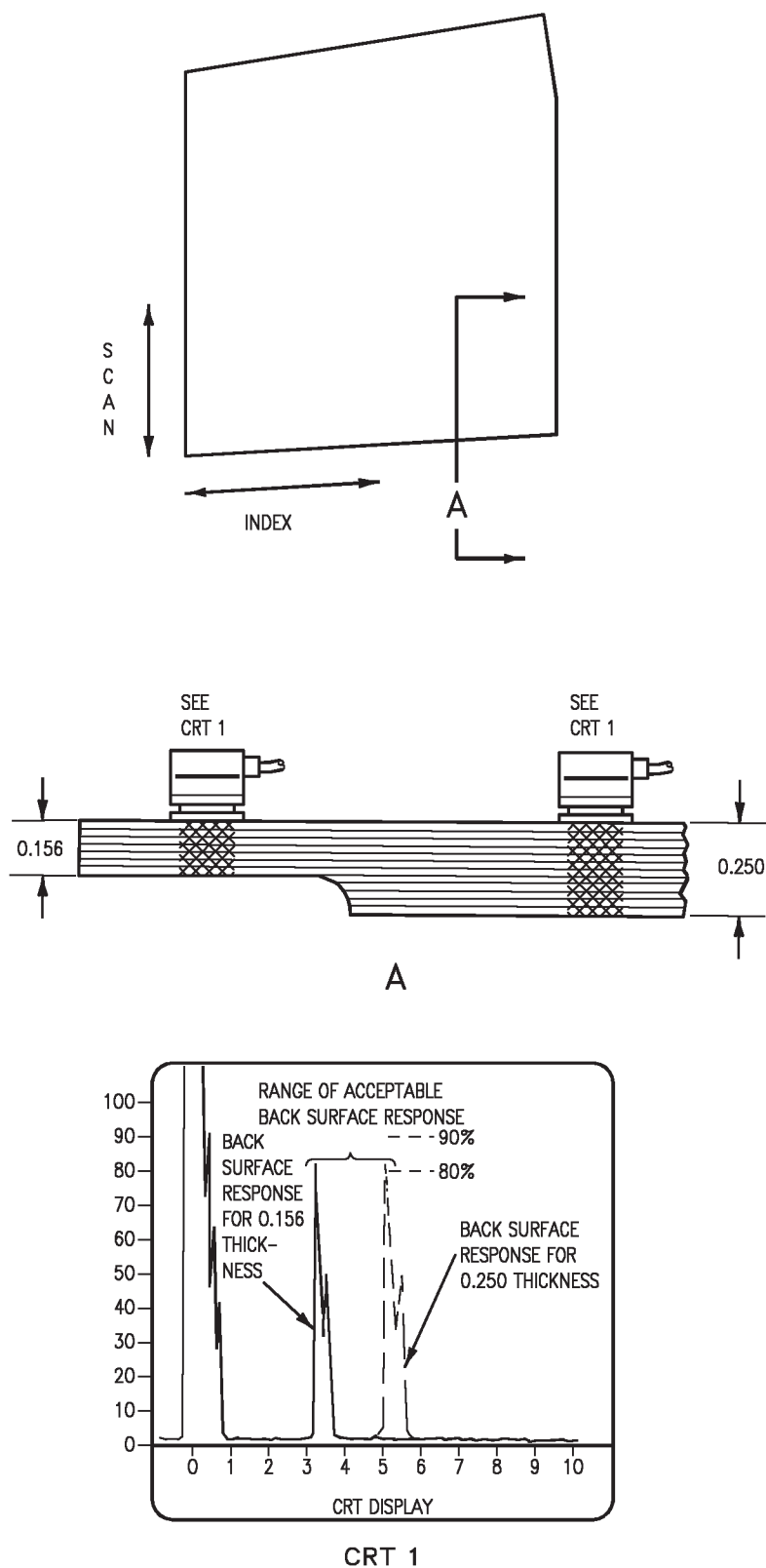


Figure 4. Typical Thicknesses and Ultrasonic Responses For Door 82

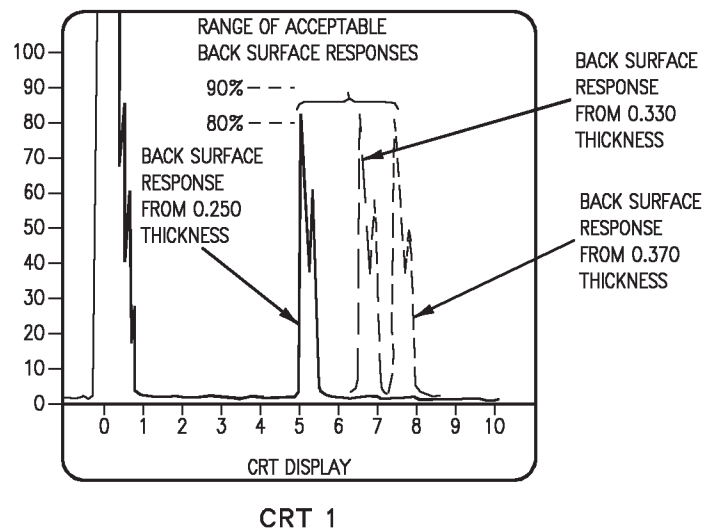
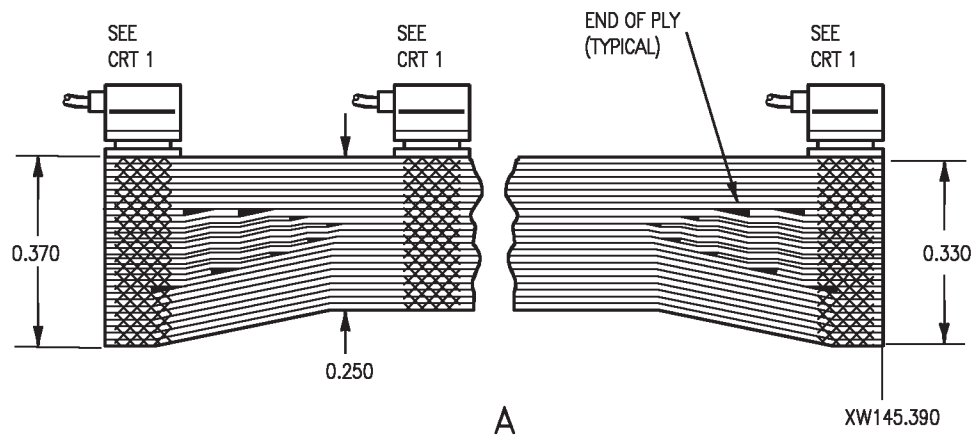
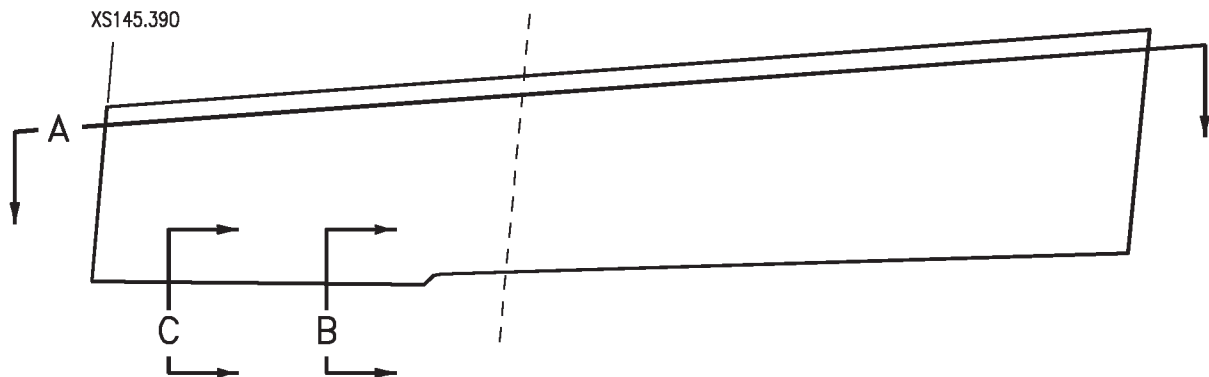
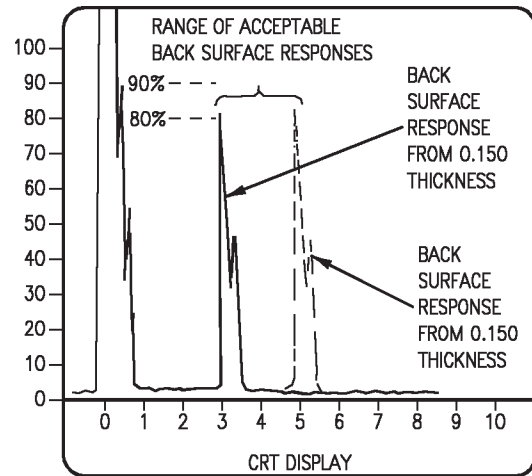
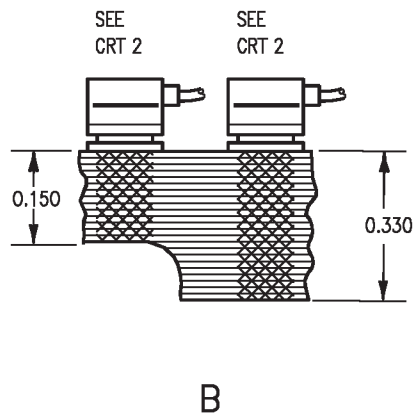
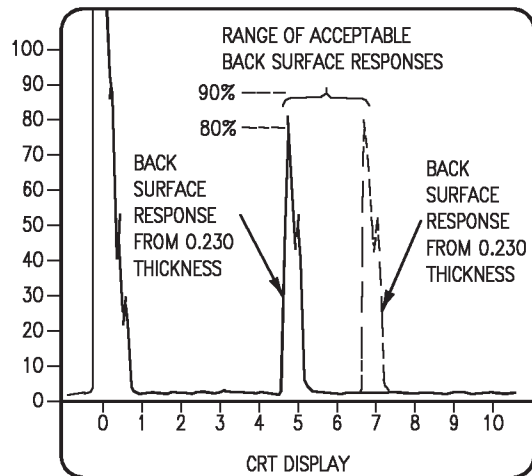
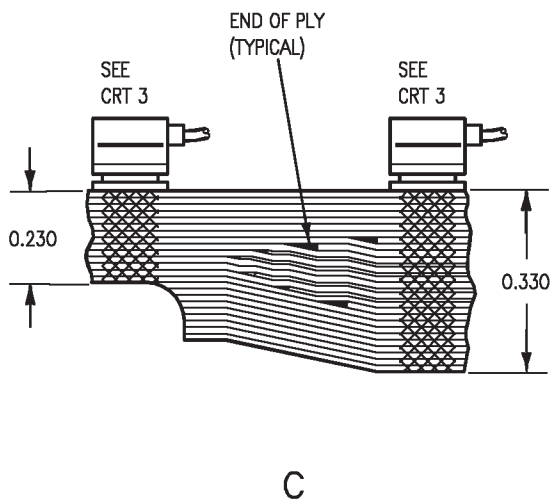


Figure 5. Typical Thicknesses and Ultrasonic Responses For Door 79 and Door 79/ 143 (Sheet 1)





CRT 2



CRT 3

Figure 5. Typical Thicknesses and Ultrasonic Responses For Door 79 and Door 79/ 143 (Sheet 2)

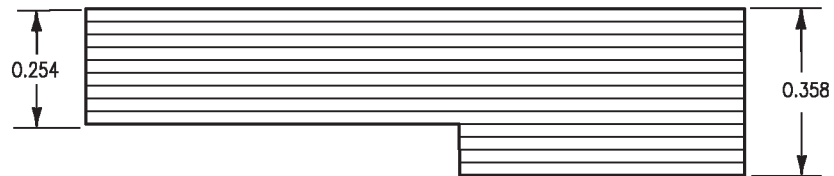


Figure 6. Typical Thickness for Lower Inboard Skin Assembly, 74A110954

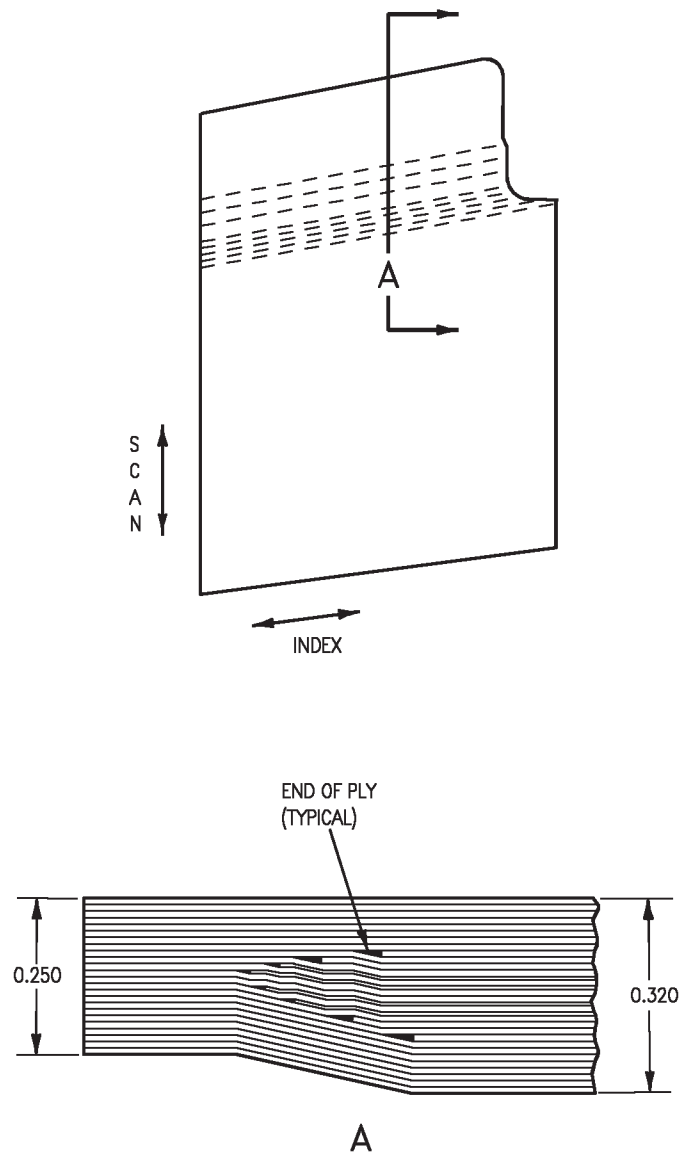


Figure 7. Typical Thickness for Door 78

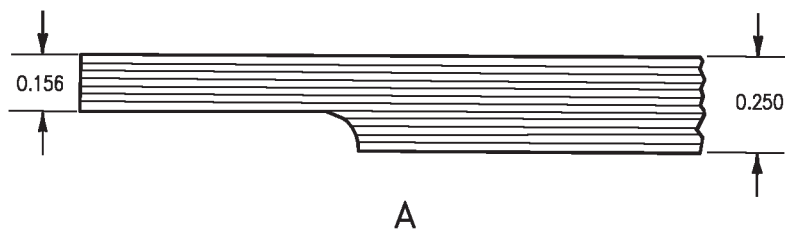
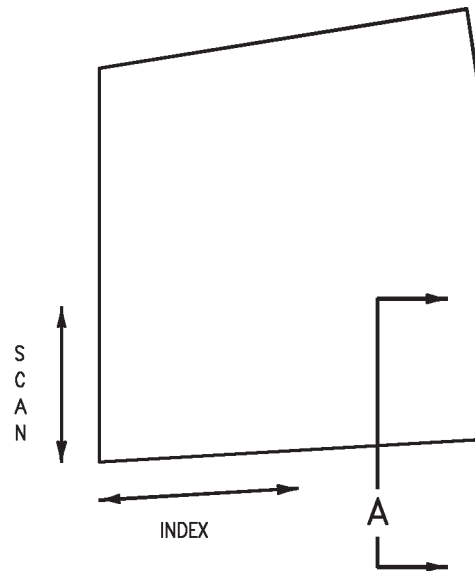


Figure 8. Typical Thickness for Door 82

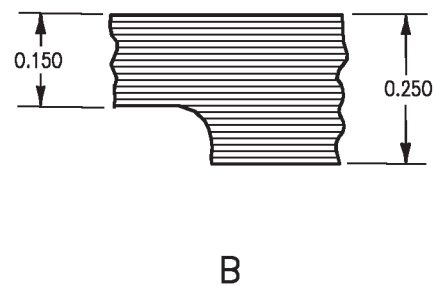
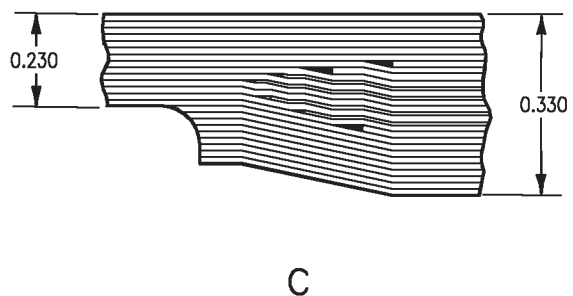
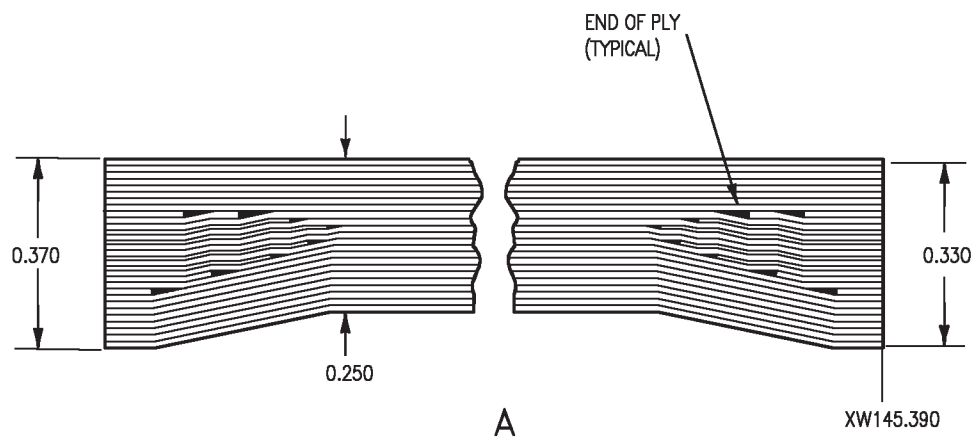
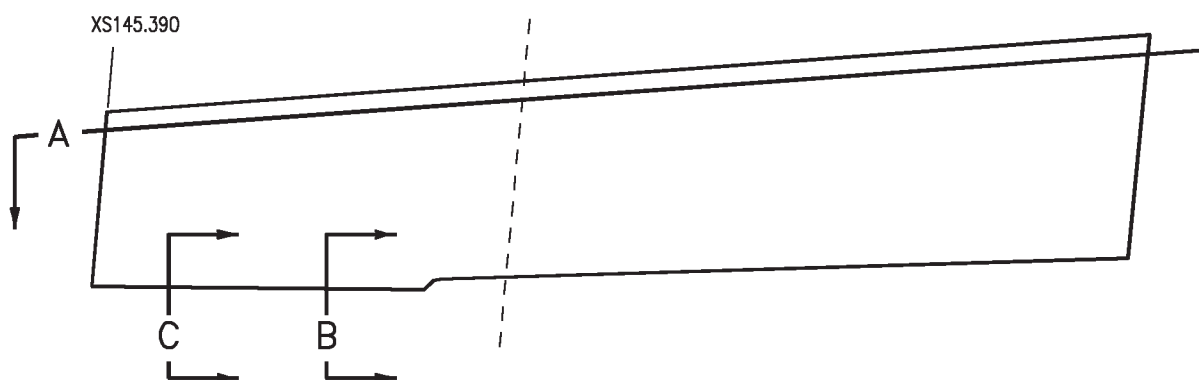


Figure 9. Typical Thickness for Door 79 and Door 79/ 143



## INTERMEDIATE MAINTENANCE

## NONDESTRUCTIVE INSPECTION

## MAIN LANDING GEAR DOORS

## WATER IN HONEYCOMB

## OUTBOARD DOOR PART NO. 74A426050

## INBOARD DOOR PART NO. 74A426030

## FORWARD DOOR PART NO. 74A426010

## Reference Material

Naval Aviation Maintenance Program .....	OPNAVINST 4790.2
Nondestructive Inspection.....	A1-F18AC-SRM-300
General Information .....	WP003 00
Radiographic Method.....	WP005 00
Nondestructive Inspection Methods .....	NAVAIR 01-1A-16

## Alphabetical Index

Subject	Page No.
Main Landing Gear Doors .....	1
Defects .....	1
Primary Inspection Method .....	1

## Record of Applicable Technical Directives

None

## 1. MAIN LANDING GEAR DOORS.

2. Main landing gear (MLG) doors, see figure 1, are bonded honeycomb assemblies. Flexible honeycomb core is 5056 aluminum alloy. Structure enclosing the core is graphite epoxy and titanium. Finish system is epoxy primer and polyurethane coatings.

3. **DEFECTS.** Inspect for water trapped in honeycomb core. Example of defect is contained in WP003 00.

4. **PRIMARY INSPECTION METHOD.** Primary inspection method is radiographic.

5. **Personnel Qualifications.** Personnel doing this nondestructive inspection should be qualified and certified to do radiographic inspections per OPNAVINST 4790.2 SERIES, NDI Technicians, NEC 7225/MOS 6044.

6. **Preparation of Aircraft.** No special preparation required.

7. **Access.** No special access required.

8. **Preparation of Part.** No special preparation required.

**Support Equipment Required**

Part Number or Type Designation	Nomenclature
314X	Film Identification Set
MIL-STD-453	Penetrameter Set
GXR7-6B	X-ray Apparatus, Portable
072000	X-ray Film Processor

**Materials Required****NOTE**

Alternate item specifications or part numbers are shown indented.

Specification or Part Number	Nomenclature
INDUSTREX M FILM CODE M2	Radiographic Film, X-ray Film, 14x17
INDUSTREXAA FILMCOEEAA2 14x17	Radiographic Film, X-ray Film, 14x17
MIL-P-83953-2, TYPE 1, CLASS A or B, RED or BLACK	Aircraft Marking Pencil
A-A-883, TYPE 1	Pressure Sensitive Tape, Masking Tape

**WARNING****HIGH RADATION**

Make sure applicable safety precautions in WP005 00 and NAVAIR 01-1A-16 are complied with. Failure to comply may result in injury to personnel.

**9. Equipment Settings/Standardization/Setup.**

Set the X-ray unit per data contained in technique chart, see figure 1.

**10. Inspection Procedure.****NOTE**

X-ray film for all shots are double loaded. AA film is located next to part and both films are exposed simultaneously.

a. Outboard door, see figure 1.

(1) Attach identification markers to inner surface of door.

(2) Attach penetrameters to outer surface of door.

(3) Locate X-ray source on deck or make sure source window is at least 60.00 inches from outer surface of door.

(4) Make sure X-ray source window is paralld to inner surface of door where film will be located, beam central ray should be perpendicular to plane of film.

(5) Locate film 1 on inner surface of door for shot 1. Make sure AA film is located next to inner surface of door or nearest X-ray source.

(6) Locate source to aiming point for shot 1. Source should be normal to aiming point and located on outer surface of door.

(7) Expose film 1 using technique chart settings for shot 1. Remove exposed film.

(8) Repeat substeps (5), (6), and (7) for films 2 through 4 and shots 2 through 4.

(9) Process exposed film. Interpret radiographs for water trapped in honeycomb core (WP005 00).

(10) Mark defect(s) using aircraft marking pencil.

b. Inboard door, see figure 1.

(1) Attach identification markers to inner surface of door.

(2) Attach penetrameters to outer surface of door.

(3) Locate X-ray source on deck or make sure source window is at least 60.00 inches from outer surface of door.



(4) Make sure X-ray source window is paralalled to inner surface of door where film will be located, beam central ray should be perpendicular to plane of film.

(5) Locate film 5 on inner surface of door for shot 5. Make sure AA film is located next to inner surface of door or nearest X-ray source.

(6) Locate source to aiming point for shot 5. Source should be normal to aiming point and located on outer surface of door.

(7) Expose film 5 using technique chart settings for shot 5. Remove exposed film.

(8) Repeat substeps (5), (6), and (7) for films 5 through 8 and shots 5 through 8.

(9) Process exposed film. Interpret radiographs for water trapped in honeycomb core (WP005 00).

(10) Mark defect(s) using aircraft marking pencil.

c. Forward Door, see figure 1.

(1) Attach identification markers to inner surface of door.

(2) Attach penetrameters to outer surface of door.

(3) Locate X-ray source on deck or make sure source window is at least 60.00 inches from outer surface of door.

(4) Make sure X-ray source window is paralalled to inner surface of door where film will be located, beam central ray should be perpendicular to plane of film.

(5) Locate film 9 on inner surface of door for shot 9. Make sure AA film is located next to inner surface of door or nearest X-ray source.

(6) Locate source to aiming point for shot 9. Source should be normal to aiming point and located on outer surface of door.

(7) Expose film 9 using technique chart settings for shot 9. Remove exposed film.

(8) Repeat substeps (5), (6), and (7) for films 9 through 17 and shots 9 through 15.

(9) Process exposed film. Interpret radiographs for water trapped in honeycomb core (WP005 00).

(10) Mark defect(s) using aircraft marking pencil.

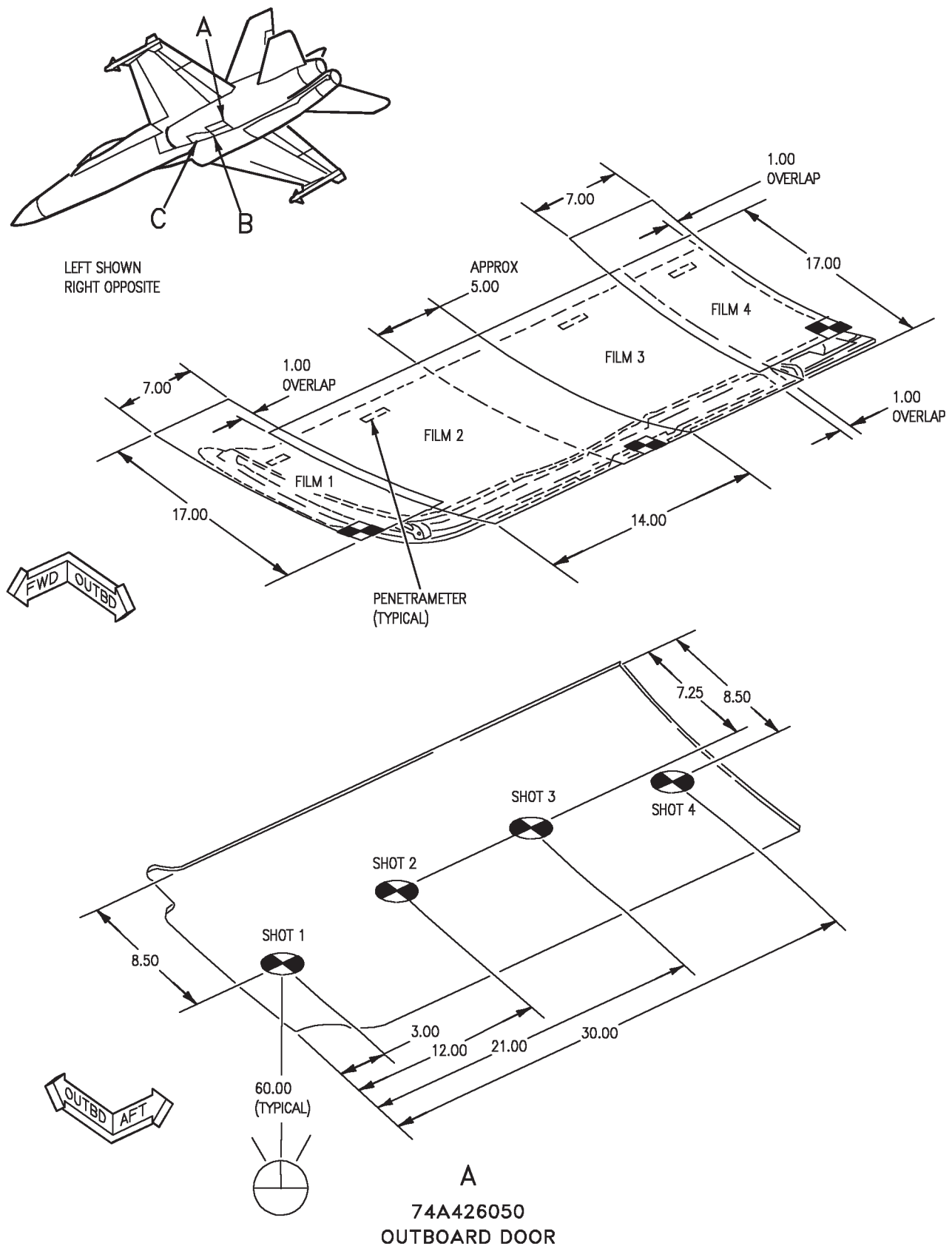


Figure 1. Main Landing Gear Doors, Water in Honeycomb (Sheet 1)

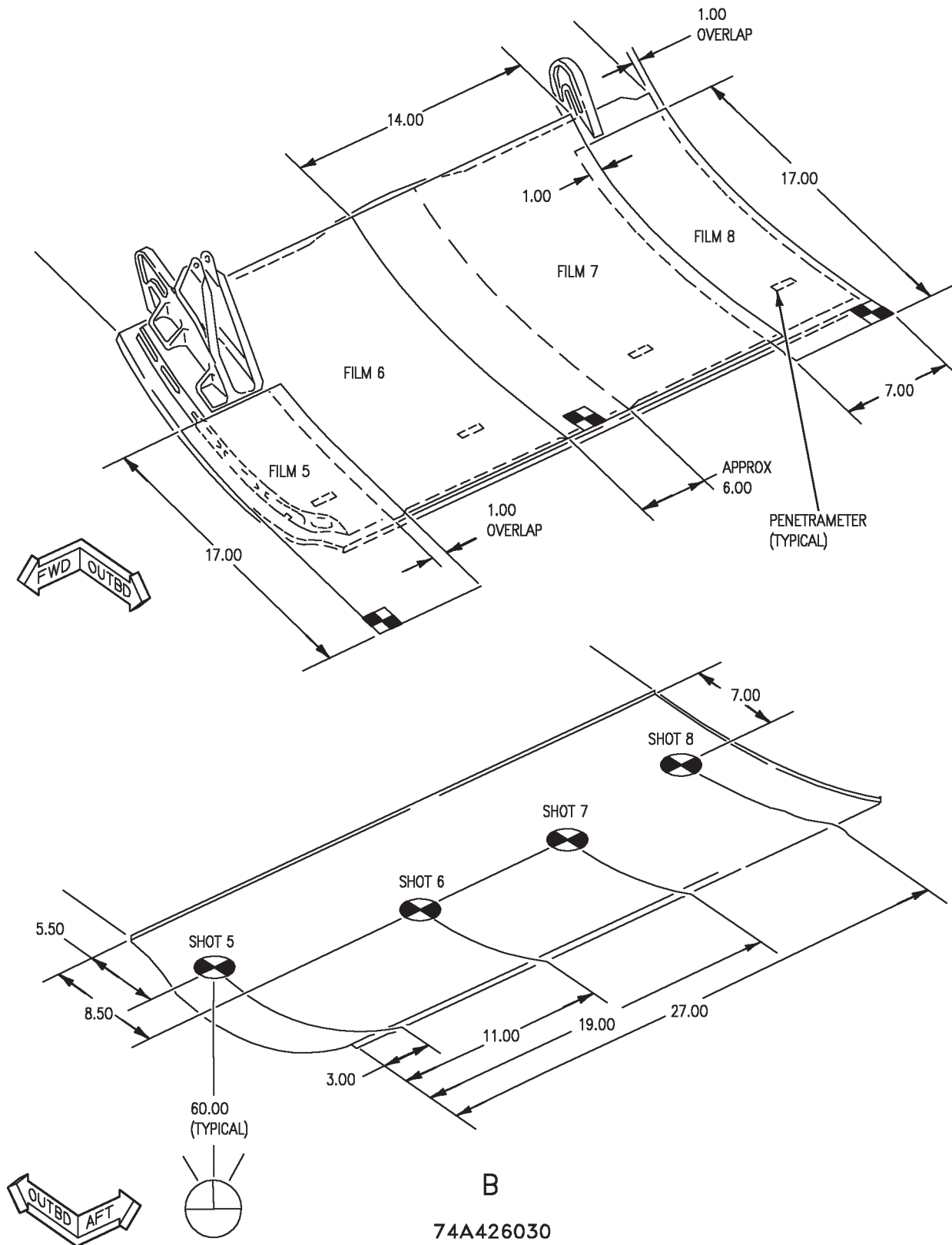
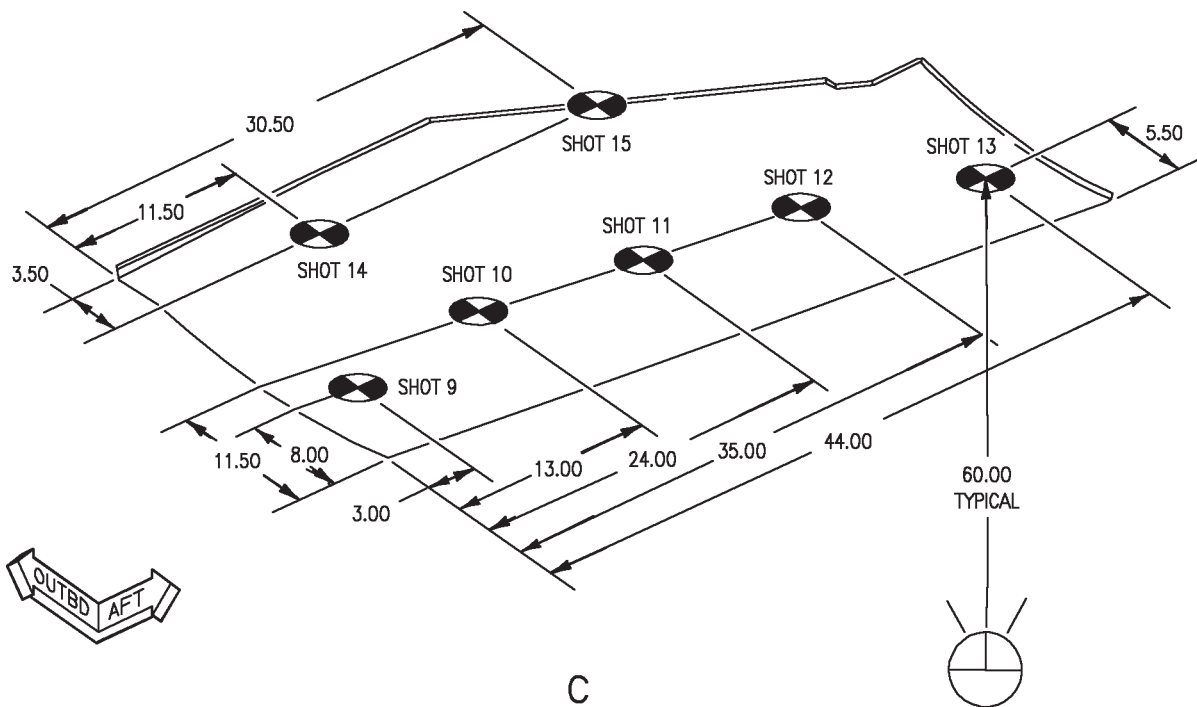
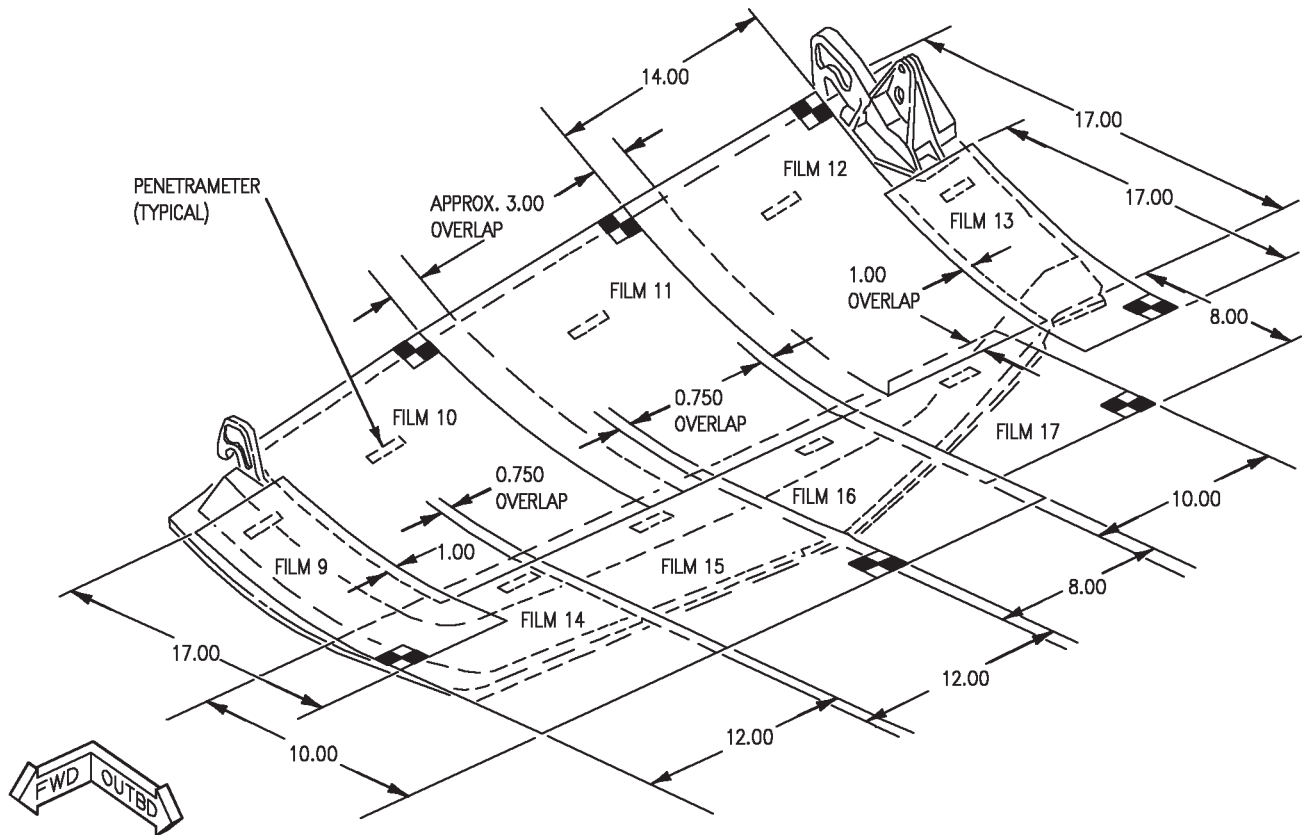


Figure 1. Main Landing Gear Doors, Water in Honeycomb (Sheet 2)



C  
74A426010  
FORWARD DOOR

Figure 1. Main Landing Gear Doors, Water in Honeycomb (Sheet 3)





TECHNIQUE CHART								
SHOT	FILM SIZE 	FILM GROUP	BACK SCREEN	PENETRATOR MIL-STD-453	mA	kVP	EXPOSURE (MINUTES)	 DENSITY
1	7 X 17	AA AND M	NO	0.25AL	5.0	45	1.0	1.0 – 3.5
2	14 X 17	AA AND M	NO	0.25AL	5.0	45	1.0	1.0 – 3.5
3	14 X 17	AA AND M	NO	0.25AL	5.0	45	1.0	1.0 – 3.5
4	7 X 17	AA AND M	NO	0.25AL	5.0	45	1.0	1.0 – 3.5
5	7 X 17	AA AND M	NO	0.25AL	5.0	45	1.0	1.0 – 3.5
6	14 X 17	AA AND M	NO	0.25AL	5.0	45	1.0	1.0 – 3.5
7	14 X 17	AA AND M	NO	0.25AL	5.0	45	1.0	1.0 – 3.5
8	7 X 17	AA AND M	NO	0.25AL	5.0	45	1.0	1.0 – 3.5
9	7 X 17	AA AND M	NO	0.25AL	5.0	45	1.0	1.0 – 3.5
10	14 X 17	AA AND M	NO	0.25AL	5.0	45	1.0	1.0 – 3.5
11	14 X 17	AA AND M	NO	0.25AL	5.0	45	1.0	1.0 – 3.5
12	14 X 17	AA AND M	NO	0.25AL	5.0	45	1.0	1.0 – 3.5
13	7 X 17	AA AND M	NO	0.25AL	5.0	45	1.0	1.0 – 3.5
14	10 X 12 10 X 12	AA AND M AA AND M	NO NO	0.25AL 0.25AL	5.0 5.0	45 45	1.0 1.0	1.0 – 3.5 1.0 – 3.5
15	8 X 10 8 X 10	AA AND M AA AND M	NO NO	0.25AL 0.25AL	5.0 5.0	45 45	1.0 1.0	1.0 – 3.5 1.0 – 3.5
<p style="text-align: center;"><b>LEGEND</b></p> <p> H AND D DENSITY UNITS. A 2.0 DENSITY IS PREFERRED.</p> <p> FOR FILM SIZES OTHER THAN 14 X 17, CUT AND BAGGED 7 X 7, 7 X 14, 7 X 17, 10 X 12, AND 8 X 10 MADE FROM 14 X 17 FILM IS ALLOWED.</p>								

Figure 1. Main Landing Gear Doors, Water in Honeycomb (Sheet 4)



## INTERMEDIATE MAINTENANCE

## NONDESTRUCTIVE INSPECTION

## MAIN LANDING GEAR OUTBOARD DOOR

## SKIN TO CORE UNBONDS AND EDGE DELAMINATIONS

## PART NO. 74A426050

## Reference Material

Naval Aviation Maintenance Program .....	OPNAVINST 4790.2
Plane Captain Manual .....	A1-F18AC-PCM-000
Nondestructive Inspection.....	A1-F18AC-SRM-300
General Information .....	WP003 00
Ultrasonic Through Transmission Contact Testing, Standardization, and Inspection Procedures for Composite Laminate Skin Bonded to Honeycomb Core.....	WP008 01
Pulse-Echo, Longitudinal Wave Contact, With Delay Line, for Composite Material .....	WP008 03
Pulse-Echo, Longitudinal Wave Contact, With Delay Line, for Composite Laminate Material Bonded to Honeycomb Core .....	WP008 04
Ultrasonic Through Transmission Contact Testing, Standardization, and Inspection Procedures for Composite Laminate and Metallic Skins Bonded to Honeycomb Core .....	WP008 10
Pulse-Echo Longitudinal, Contact, With Delay Line, For Composite Lami- nate Materials.....	WP008 12
Pulse-Echo Longitudinal, Contact, With Delay Line, For Composite Lami- nates Bonded to Honeycomb Core.....	WP008 13

## Alphabetical Index

Subject	Page No.
Main Landing Gear Outboard Door.....	2
Defects .....	2
Post Inspection Cleaning and Corrosion Control.....	5
Primary Inspection Method .....	2
Ultrasonic Method Using C-398 Ultrasonic Flaw Detector .....	2
Ultrasonic Method Using MXU-715/E Ultrasonic Flaw Detector .....	4

## Record of Applicable Technical Directives

None

## 1. MAIN LANDING GEAR OUTBOARD DOOR.

2. Main landing gear outboard door, see figures 1 and 2, is bonded honeycomb core assembly. Honeycomb core is 5056 aluminum alloy, F80, flexible core. Structure enclosing core is graphite epoxy and titanium. Skins are graphite epoxy composite laminate. Skin to core bonds are made with FM-300 film adhesive. Core to core, structure to core, and stuffed core bonds are made with foaming adhesive. Surface finish is epoxy primer and polyurethane coatings.

3. **DEFECTS.** Inspect for skin to core unbonds and edge delaminations. Examples of skin to core unbonds and delaminations are contained in (WP003 00).

4. **PRIMARY INSPECTION METHOD.** Primary inspection methods are ultrasonic through transmission and pulse-echo.

5. **Personnel Qualifications.** Personnel doing this nondestructive inspection shall be qualified and certified to do ultrasonic inspections per OPNAVINST 4790.2 SERIES, NDI Technicians, NEC 7225/MOS 6044.

6. **Preparation of Aircraft.** No special preparation required.

7. **Access.** No special access required.

## 8. ULTRASONIC METHOD USING C-398 ULTRASONIC FLAW DETECTOR.

### Support Equipment Required

#### NOTE

Alternate item type designations or part numbers are listed in parentheses.

Part Number or Type Designation	Nomenclature
C-398 (303B)	Ultrasonic Flaw Detector
57A2271 or EQUIVALENT	Microdot to BNC Connecting Cable, 2 Req'd.

### Support Equipment Required (Continued)

#### NOTE

Alternate item type designations or part numbers are listed in parentheses.

Part Number or Type Designation	Nomenclature
57A2276 or EQUIVALENT	0°, 0.500 Dia., 2.25 MHz, Contact Search Unit, 2 Req'd.
GD0504	0°, 0.250 Dia., 5 MHz, Delay Line Contact Search Unit
74D110175-1001	Graphite Epoxy Reference Standard Set Containing Following:
74D111295-1009	Graphite Epoxy Flat Bottom Hole Reference Standard for Laminates up to 0.450 Inch
74D111295-1005	Honeycomb Reference Standard With Graphite Epoxy Skins for Sandwich Assemblies Less Than 1 Inch

### Materials Required

Specification or Part Number	Nomenclature
ULTRAGEL II MIL-P-83953-2, TYPE 1, CLASS A or B, RED or BLACK	Couplant Aircraft Marking Pencil
P-D-680, TYPE 2 D 1153	Dry Cleaning Solvent Methyl Isobutyl Ketone
CCC-C-46, TYPE 1 Class 4	Cleaning Cloth



**WARNING**

Dry cleaning solvent and methyl isobutyl ketone are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

9. **Preparation of Part.** Clean inspection area(s) with water or, if required, solvent moistened cloth to make sure inspection area(s) is free of contamination of foreign material.

**WARNING**

Make sure safety precautions have been met for electrical, static, grounding when using ultrasonic equipment near aircraft fuel cells, oxygen systems, electronic systems, and stores (A1-F18AC-PCM-000).

10. **Equipment Settings/Standardization/Setup for Skin to Core and Thick Laminate Areas.** See figure 3, Do standardization per (WP008 01), and as specified below:

- a. Use two 57A2276 search units.
- b. Use P-1 calibration point on 74D111295-1005 graphite epoxy skinned honeycomb core sandwich assembly reference standard.

11. **Inspection Procedure for Skin to Core and Thick Laminate Areas.** See figures 4 through 9. After standardization, inspect skin to core area of door per (WP008 01), except as specified below:

- a. Use two 57A2276 search units.
- b. Apply couplant to both surfaces of inspection area(s).
- c. Make sure initial pulse width does not interfere with location of received response. If required, switch position of search units on microdot cables or use different search unit on receiver cable.
- d. Inspect thick laminate areas of formers as shown in figure 10.

e. Use ultrasonic pulse-echo per (WP008 04) to determine if suspect areas are result of skin delaminations. Do pulse-echo inspection on both surfaces to help identify location of flaws causing through transmission unbond response.

**WARNING**

12. **Equipment Settings/Standardization/Setup for Thin Laminate and Skin and Structure Areas.**

Do standardization for thin laminates and skin to structure areas per (WP008 03), making sure trailing edge of initial pulse is located at less than 1 large division when 0.100 inch FBH response is 80 to 90 percent CRT height.

13. **Inspection Procedure for Thin Laminate and Skin to Structure Areas.** Inspect thin laminate and skin to structure areas per (WP008 03) and the following:

- a. Apply couplant to solid laminate inspection area where laminate thickness is known.
- b. Make sure leading edge of back surface response is located at correct location on horizontal baseline when peak amplitude is 80 to 90 percent CRT height.
- c. Scan area to be inspected, finger damping back surface response as often as required to make sure correct response is being received. Finger damp by placing couplant on end of finger and touching opposite surface. As finger touches and is removed from part surface, reflected response on CRT will move up and down as it is damped, indicating good bond.
- d. For inspection responses in addition to those described in (WP008 03), refer to figure 11 for good responses, and 12 for unbond responses.
- e. Use pulse-echo mapping techniques per (WP008 03) to determine extent of flaw indication.
- f. Do paragraph 20.

#### 14. ULTRASONIC METHOD USING MXU-715/E ULTRASONIC FLAW DETECTOR.

##### Support Equipment Required

Part Number or Type Designation	Nomenclature
1642AS100-1	Ultrasonic Flaw Detector, MXU-715/E, Magnaflux
57A2271 or EQUIVALENT	Microdot to BNC Connecting Cable, 2 Req'd.
57A2276 or EQUIVALENT	0°, 0.500 Dia., 2.25 MHz, Contact Search Unit, 2 Req'd.
GD0504	0°, 0.250 Dia., 5 MHz, Delay Line Contact Search Unit
74D110175-1001	Graphite Epoxy Reference Standard Set Containing Following:
74D111295-1009	Graphite Epoxy Flat Bottom Hole Reference Standard for Laminates up to 0.450 Inch
74D111295-1005	Honeycomb Reference Standard With Graphite Epoxy Skins for Sandwich Assemblies Less Than 1 Inch

##### Materials Required

Specification or Part Number	Nomenclature
ULTRAGEL II	Couplant
MIL-P-83953-2, TYPE 1, CLASS A or B, RED or BLACK	Aircraft Marking Pencil
P-D-680, TYPE 2 D 1153	Dry Cleaning Solvent Methyl Isobutyl Ketone
CCC-C-46, TYPE 1 Class 4	Cleaning Cloth

#### WARNING

Dry cleaning solvent and methyl isobutyl ketone are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

15. **Preparation of Part.** Clean inspection area(s) with water or, if required, solvent moistened cloth to make sure inspection area(s) is free of contamination of foreign material.

16. **Equipment Settings/Standardization/Setup for Skin to Core and Thick Laminate Areas.** See figure 3. Do standardization per (WP008 10), and as specified below:

#### WARNING

Make sure safety precautions have been met for electrical, static, grounding when using ultrasonic equipment near aircraft fuel cells, oxygen systems, electronic systems, and stores (A1-F18AC-PCM-000).

a. Use two 57A2276 search units.

b. Use P-1 calibration point on 74D111295-1005 graphite epoxy skinned honeycomb core sandwich assembly reference standard.

17. **Inspection Procedure for Skin to Core and Thick Laminate Areas.** See figures 4 through 9. After standardization, inspect skin to core area of door per (WP008 10), except as specified below:

a. Use two 57A2276 search units.

b. Apply couplant to both surfaces of inspection area(s).

c. Make sure initial pulse width does not interfere with location of received response. If required, switch position of search units on microdot cables or use different search unit on receiver cable.

d. Inspect thick laminate areas of formers as shown in figure 10.

e. Use ultrasonic pulse-echo per (WP008 13) to determine if suspect areas are result of skin delaminations. Do pulse-echo inspection on both surfaces to help identify location of flaws causing throughtransmission unbond response.

## WARNING

### 18. Equipment Settings/Standardization/Setup for Thin Laminate and Skin and Structure Areas.

Do standardization for thin laminates and skin to structure areas per (WP008 12), making sure trailing edge of initial pulse is located at less than 1 large division when 0.100 inch FBH response is 80 to 90 percent CRT height.

**19. Inspection Procedure for Thin Laminate and Skin to Structure Areas.** Inspect thin laminate and skin to structure areas per (WP008 12) and the following:

- a. Apply couplant to solid laminate inspection area where laminate thickness is known.
- b. Make sure leading edge of back surface response is located at correct location on horizontal baseline when peak amplitude is 80 to 90 percent CRT height.
- c. Scan area to be inspected, finger damping back surface response as often as required to make

sure correct response is being received. Finger damp by placing couplant on end of finger and touching opposite surface. As finger touches and is removed from part surface, reflected response on CRT will move up and down as it is damped, indicating good bond.

d. For inspection responses in addition to those described in (WP008 12), refer to figure 11 for good responses, and figure 12 for unbond responses.

e. Use pulse-echo mapping techniques per (WP008 12) to determine extent of flaw indication.

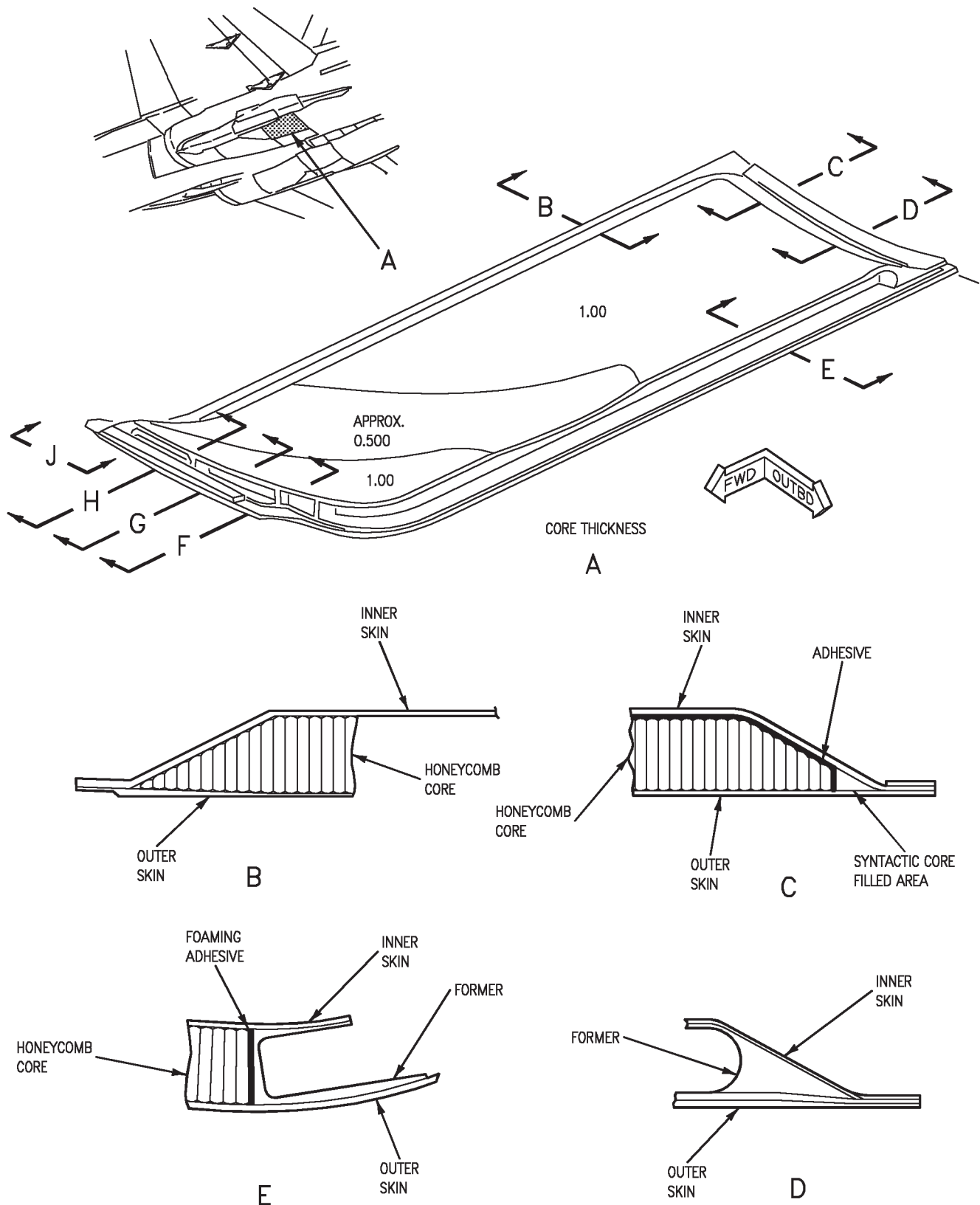
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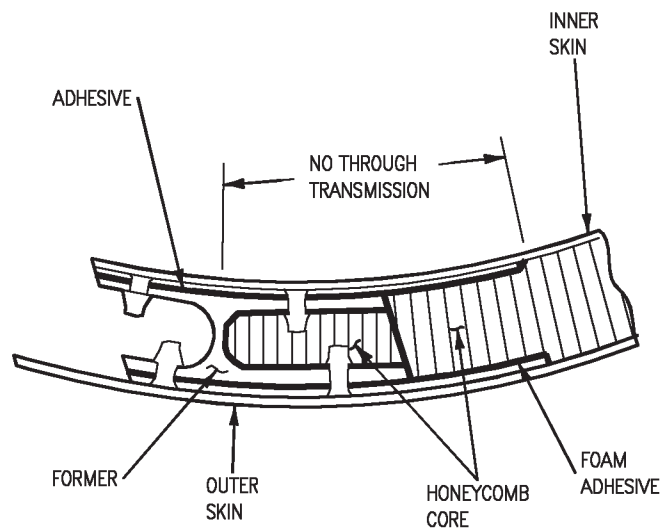
Dry cleaning solvent and methyl isobutyl ketone are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

**20. POST INSPECTION CLEANING AND CORROSION CONTROL.** Clean couplant and markings from flap with water, if required, solvent moistened cloth.

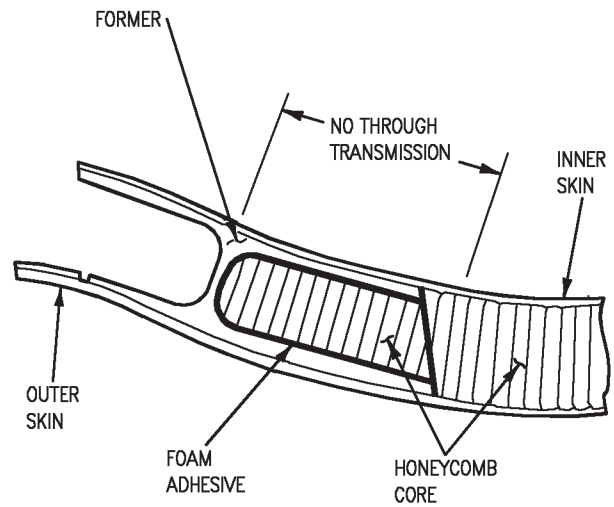




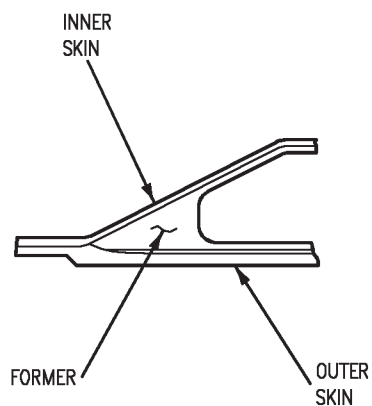




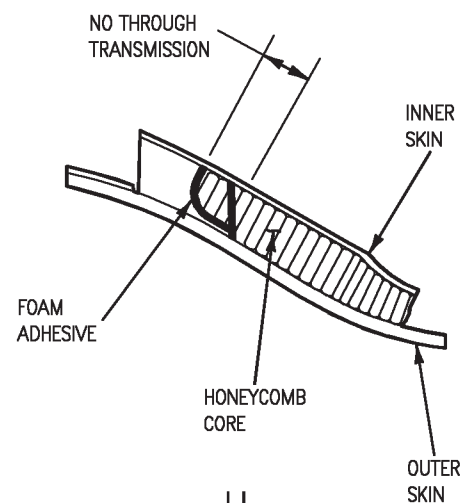
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G



J



H

Figure 1. Structure and Core Thickness (Sheet 2)

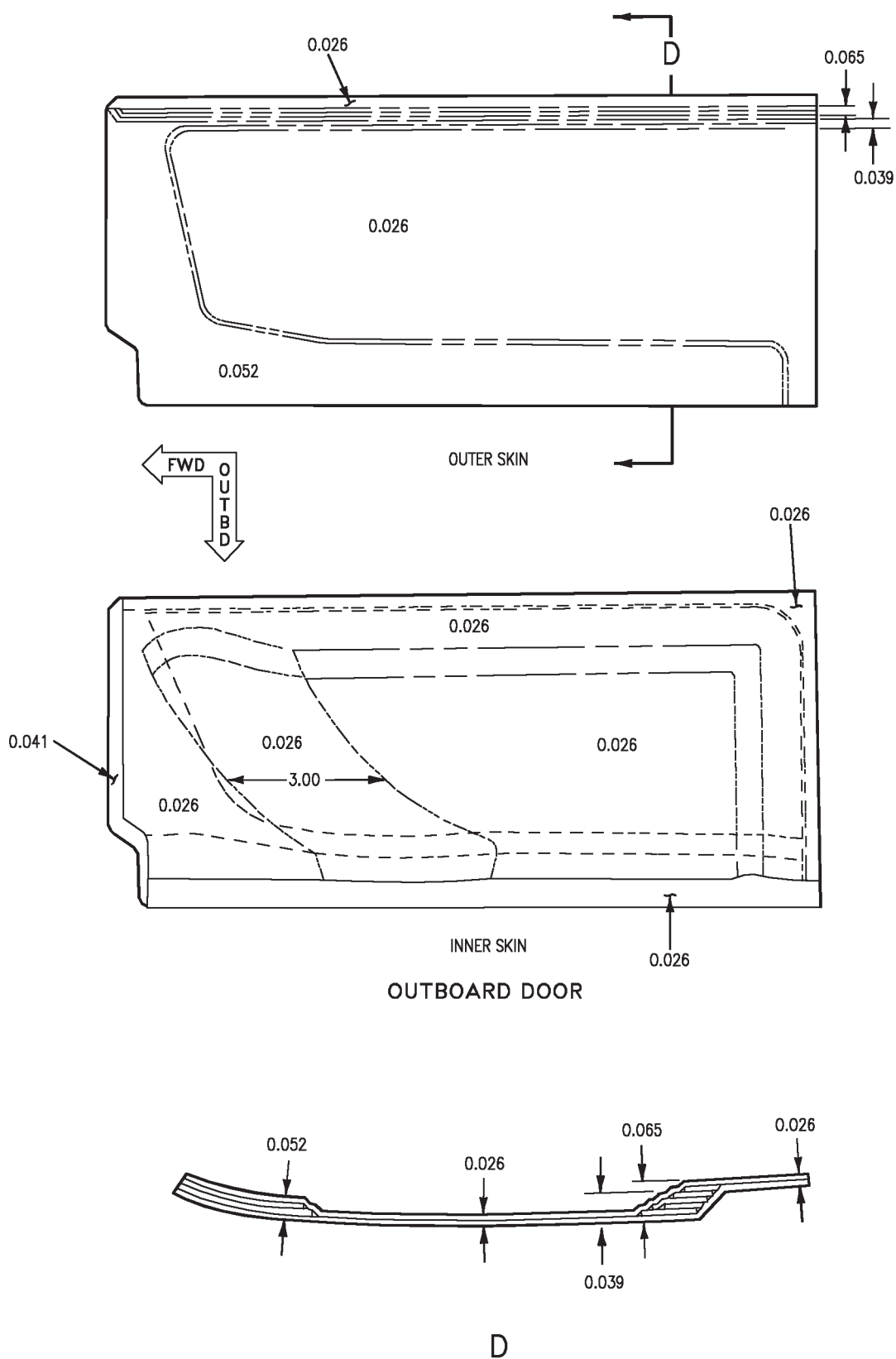
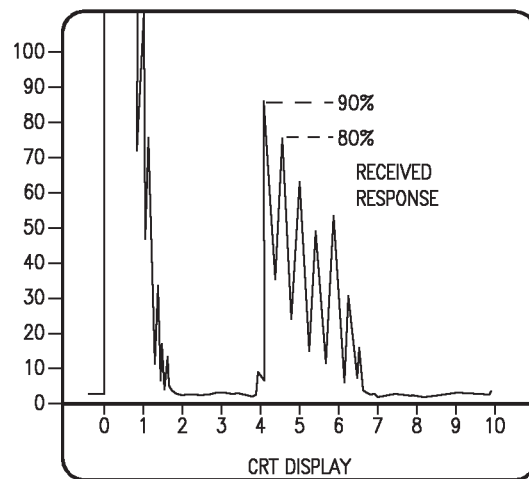
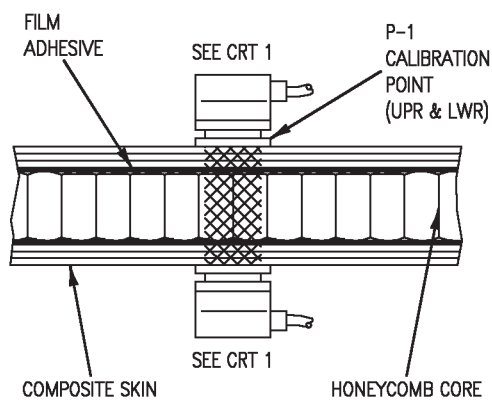


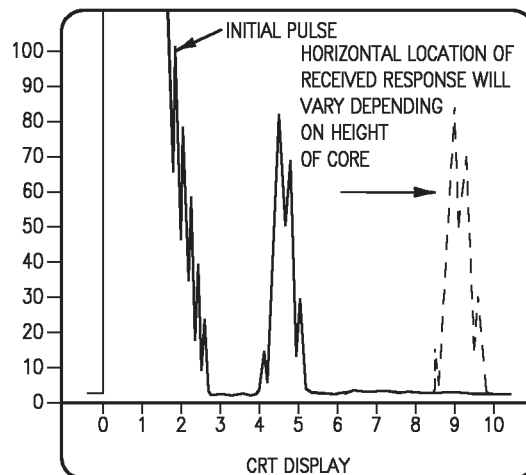
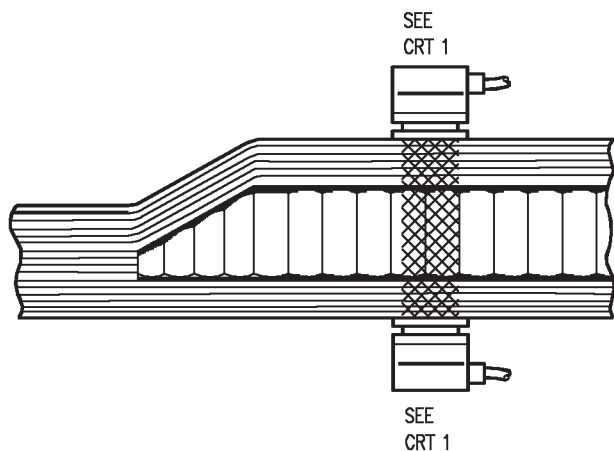
Figure 2. Typical Skin Thicknesses





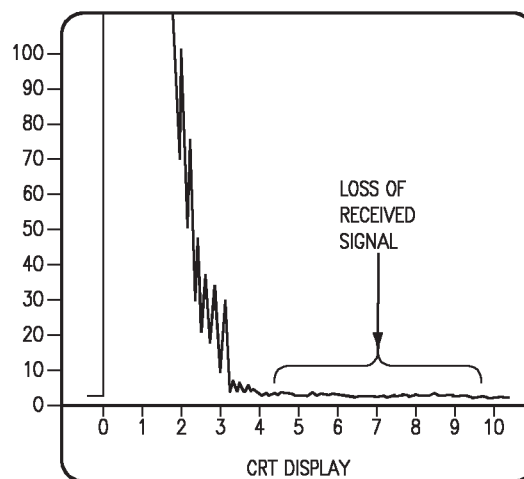
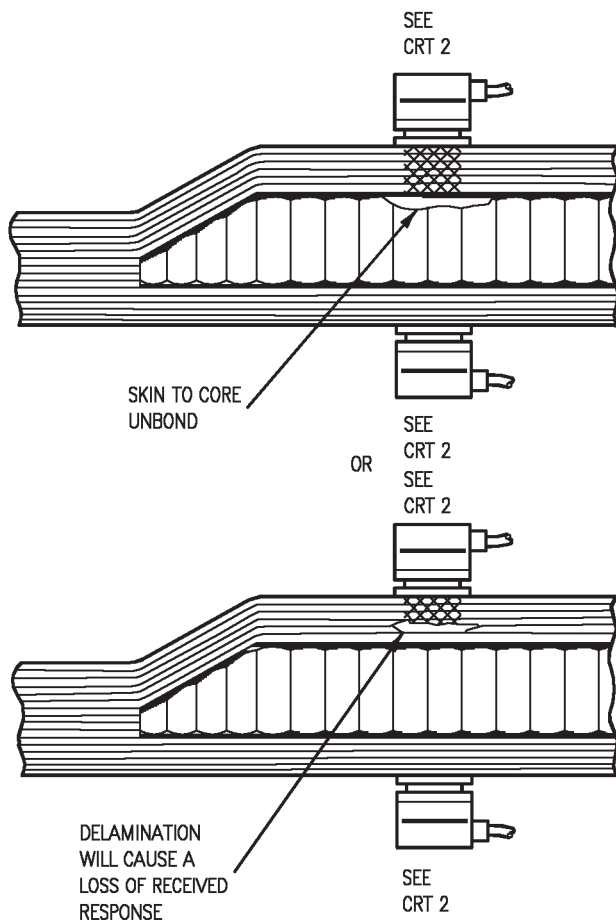
CRT 1

LEADING EDGE OF RECEIVED RESPONSE  
LOCATED AT 4 ON THE HORIZONTAL BASELINE.



**CRT 1**

(TYPICAL) SKIN TO CORE  
GOOD BOND RESPONSE



**CRT 2**

(TYPICAL) SKIN TO CORE  
UNBOND RESPONSE

**Figure 4. Honeycomb Core Inspection Responses**

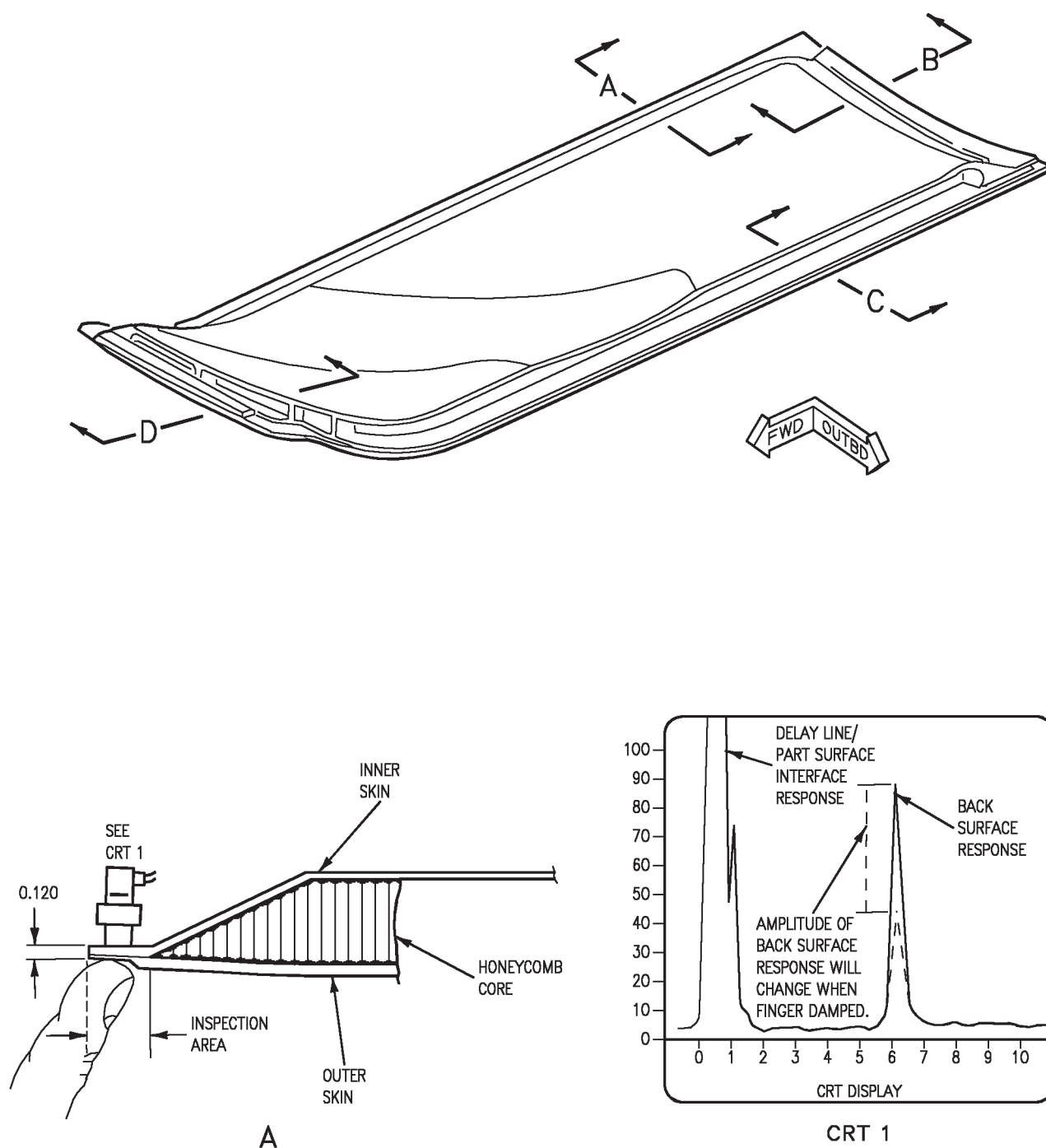


Figure 5. Inspection Area Thickness and Typical Good Responses (Sheet 1)

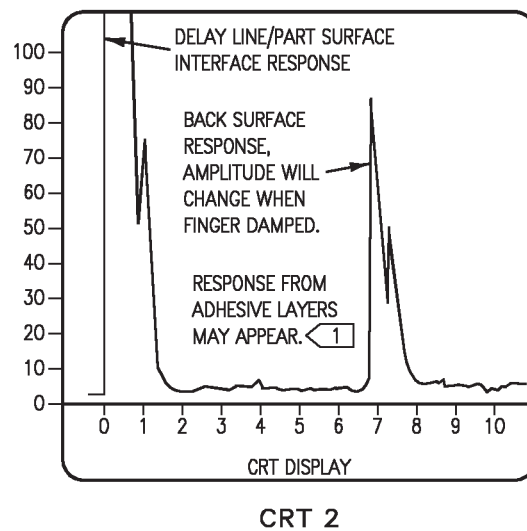
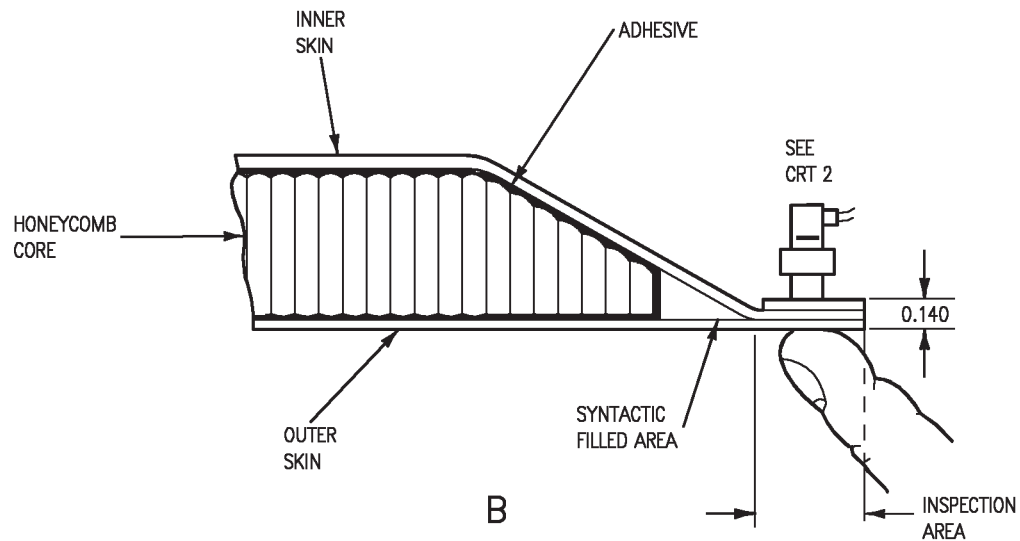
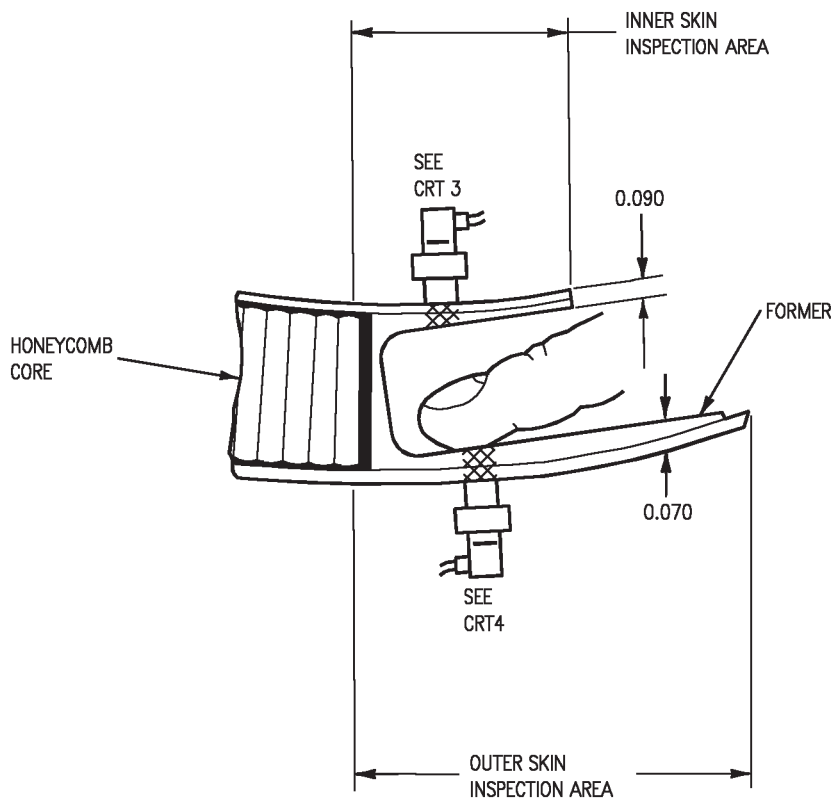
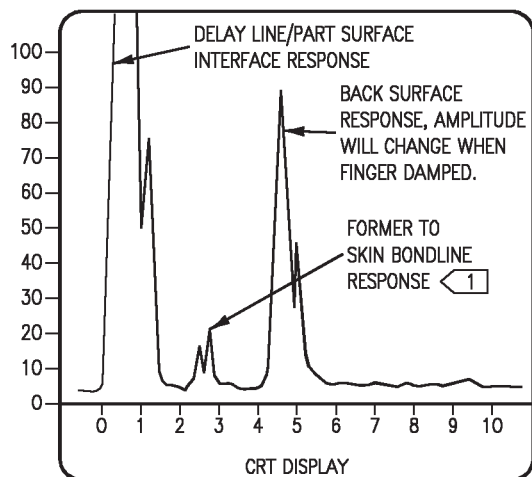


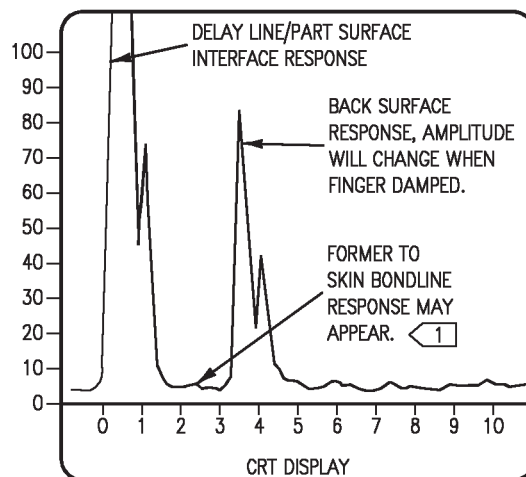
Figure 5. Inspection Area Thickness and Typical Good Responses (Sheet 2)



C

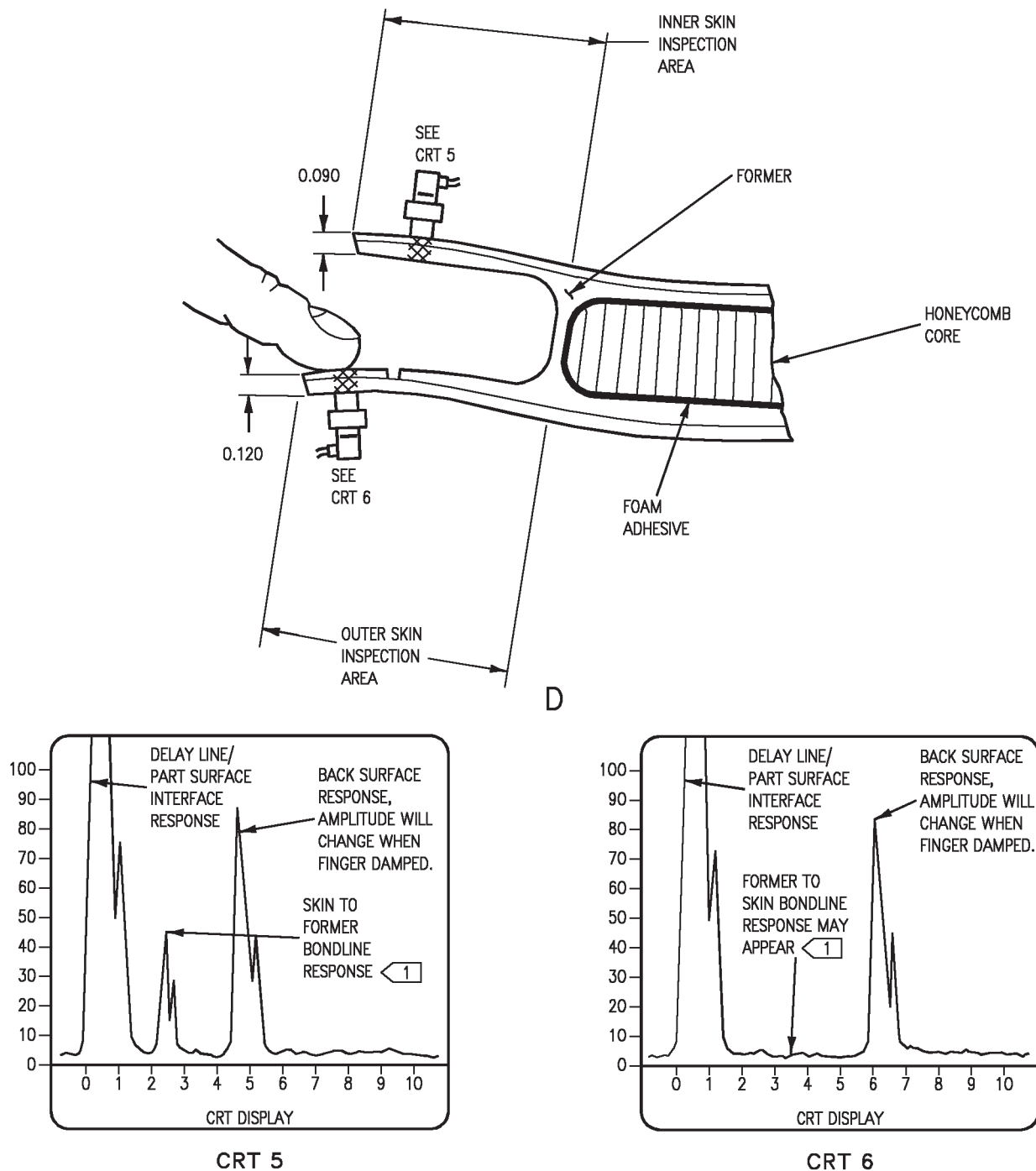


CRT 3



CRT 4

Figure 5. Inspection Area Thickness and Typical Good Responses (Sheet 3)



## LEGEND

- 1 AMPLITUDE AND LOCATION OF RESPONSE MAY DIFFER FROM DISPLAY SHOWN, BUT WILL NOT CHANGE WHEN BACK SURFACE IS DAMPED.

Figure 5. Inspection Area Thickness and Typical Good Responses (Sheet 4)

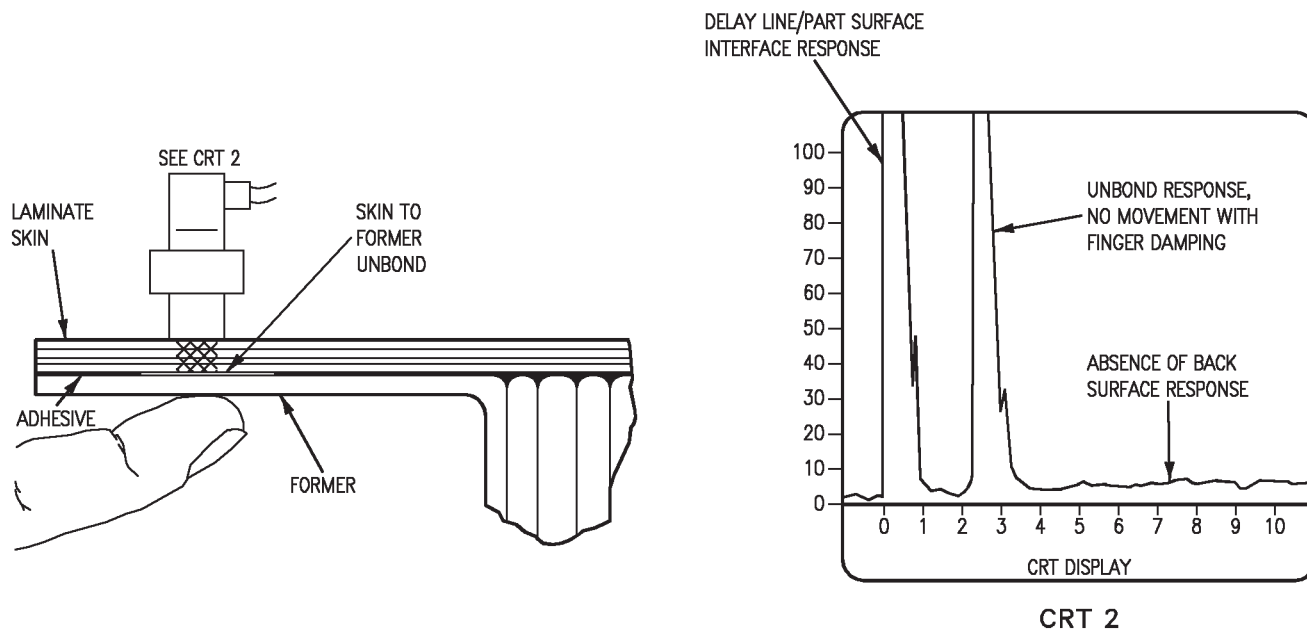
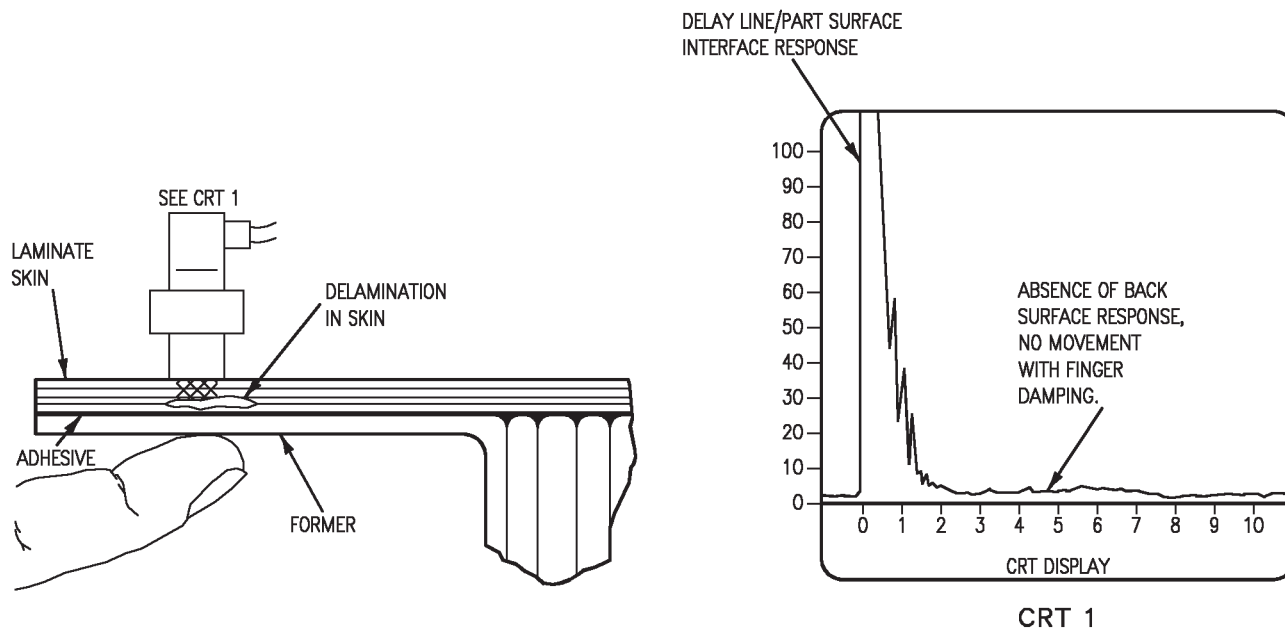


Figure 6. Typical Delamination and Unbond Responses (Sheet 1)

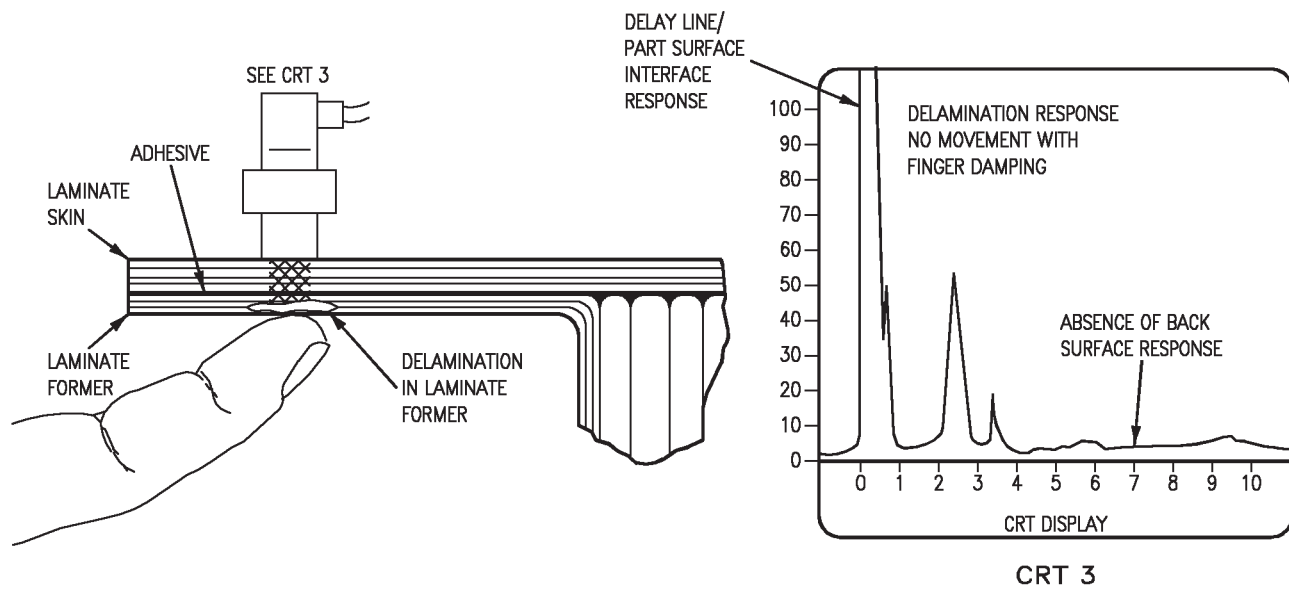
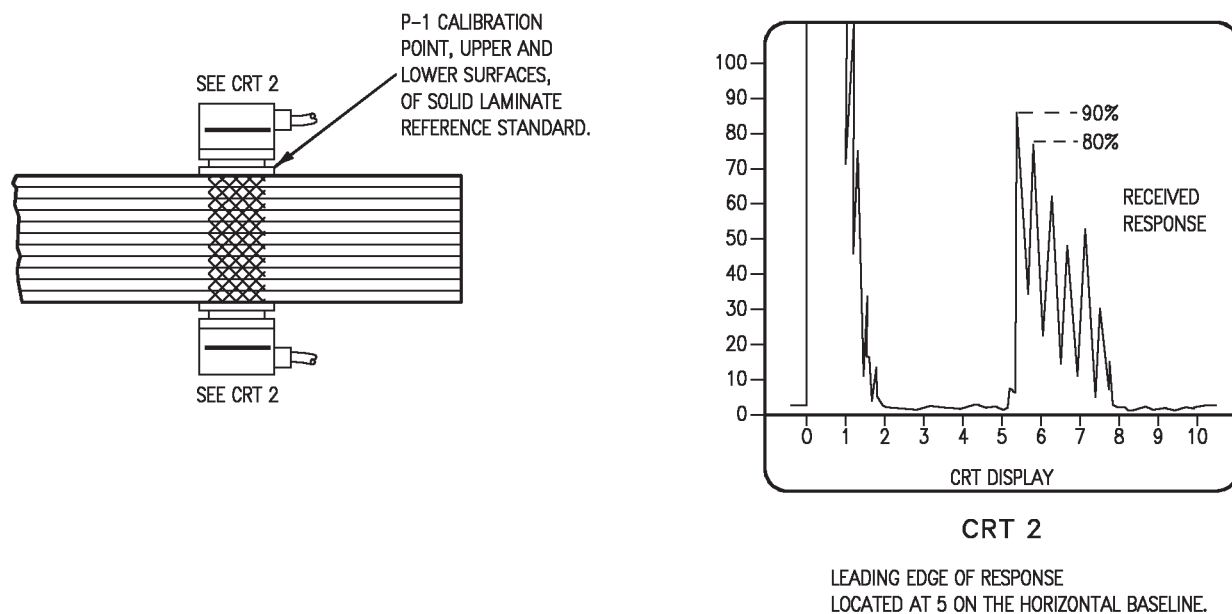
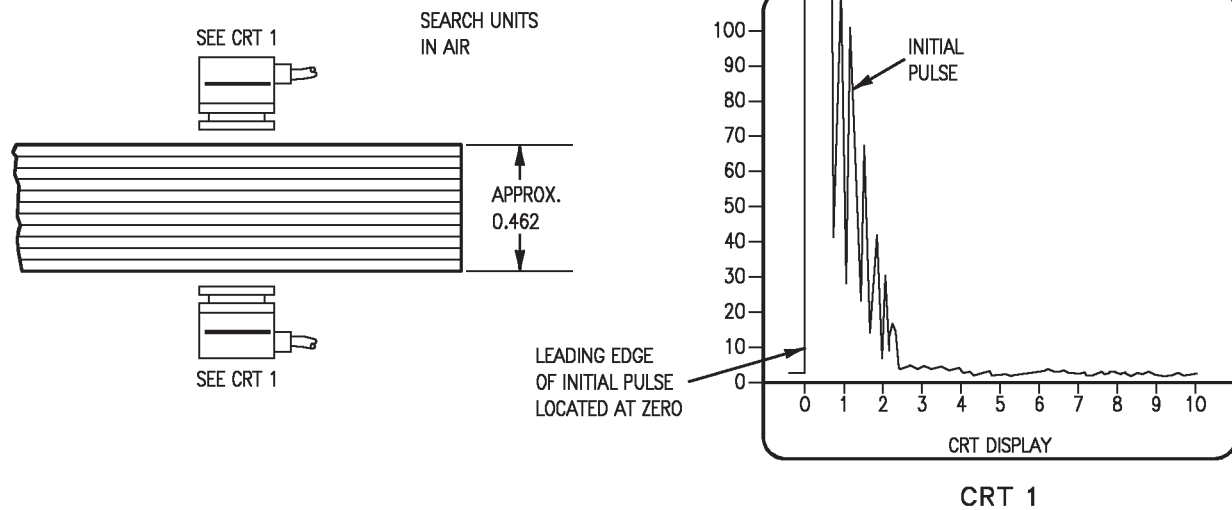
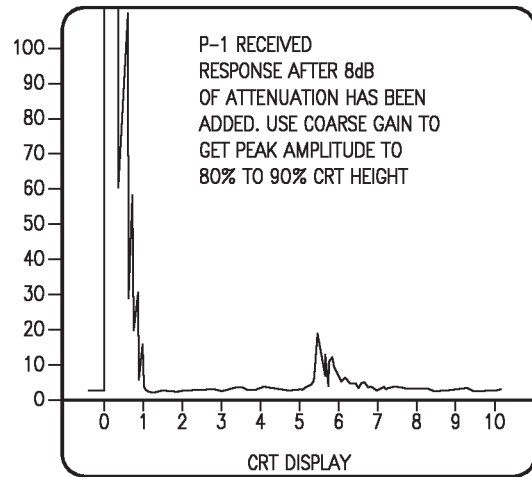
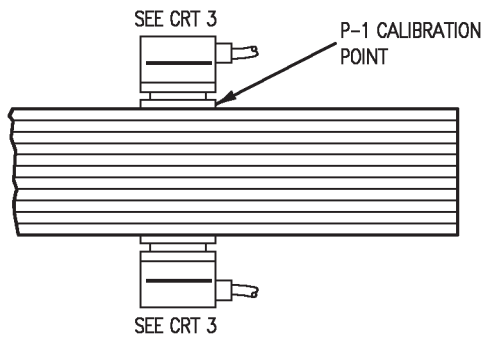


Figure 6. Typical Delamination and Unbond Responses (Sheet 2)

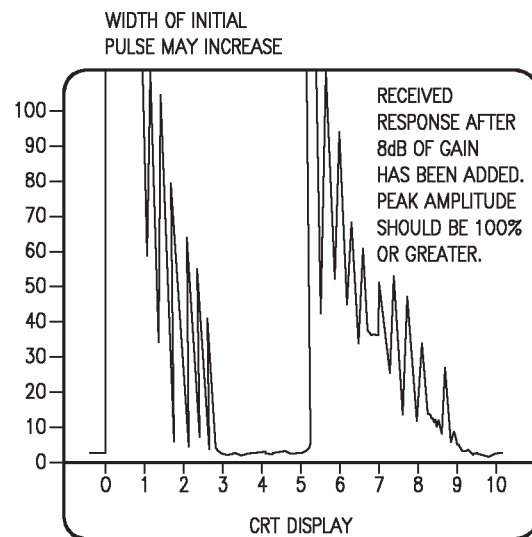
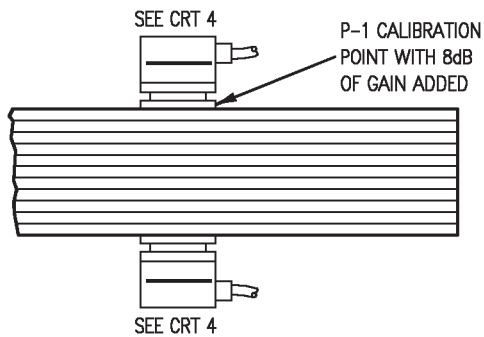




**Figure 7. Standardization For Solid Laminate and Former Areas With Thicknesses Greater Than 0.190 (Sheet 1)**



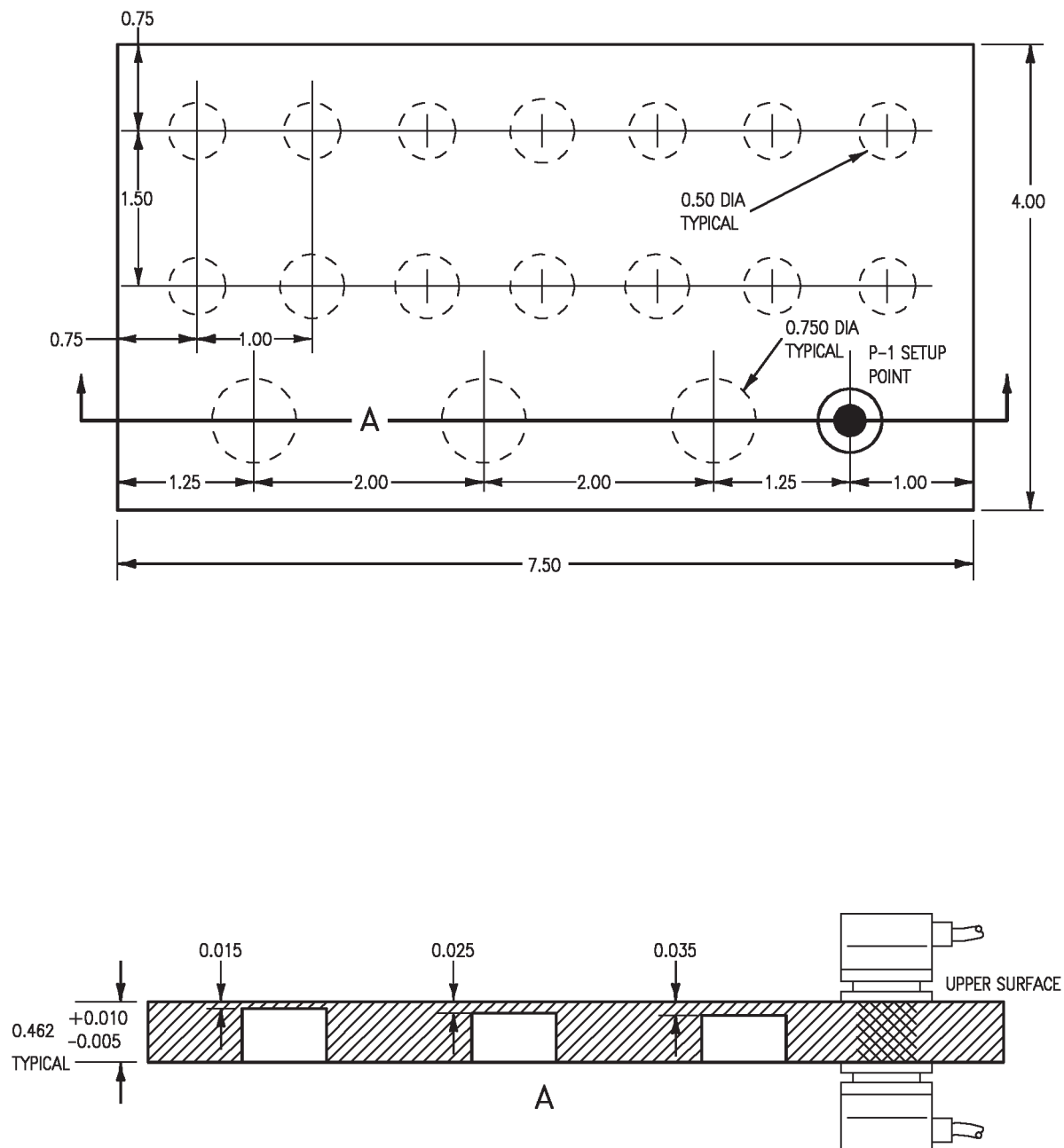
CRT 3



CRT 4

LEADING EDGE OF RECEIVED RESPONSE  
SHOULD STILL BE LOCATED AT 4.

**Figure 7. Standardization For Solid Laminate and Former Areas With Thicknesses Greater Than 0.190 (Sheet 2)**

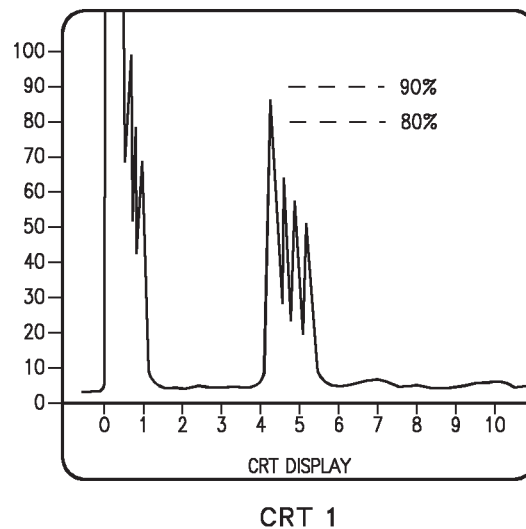
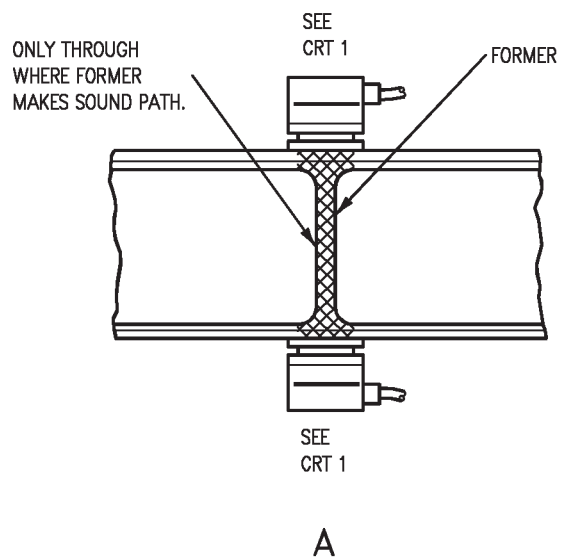
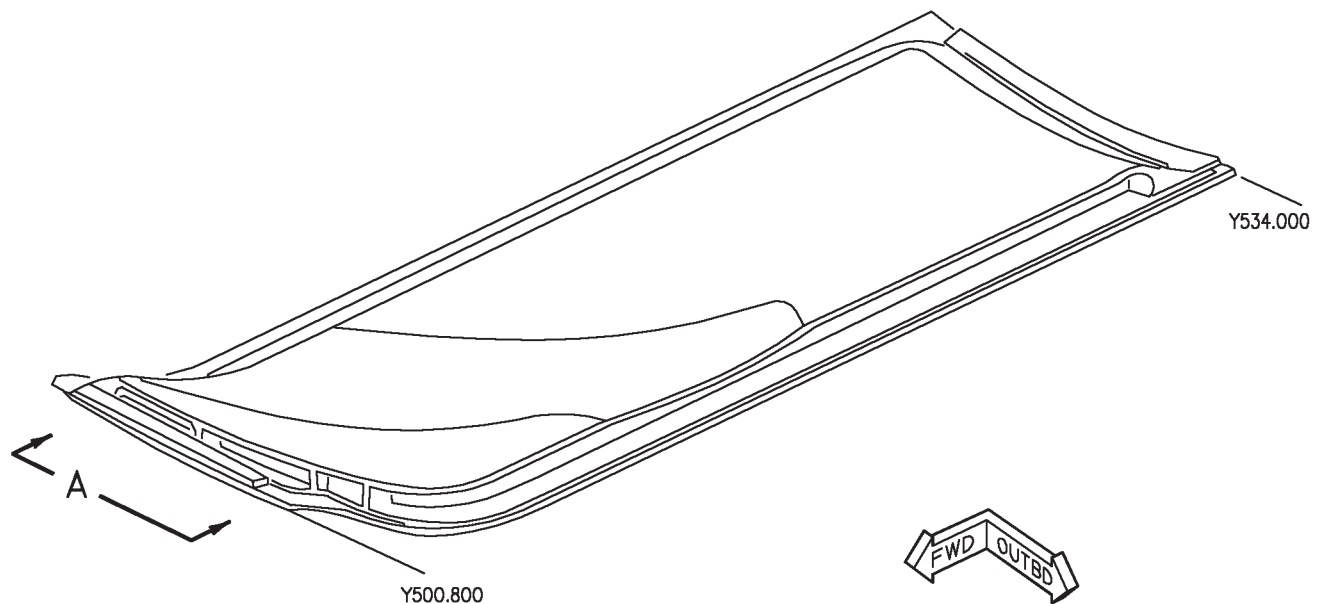


74D111295-1009

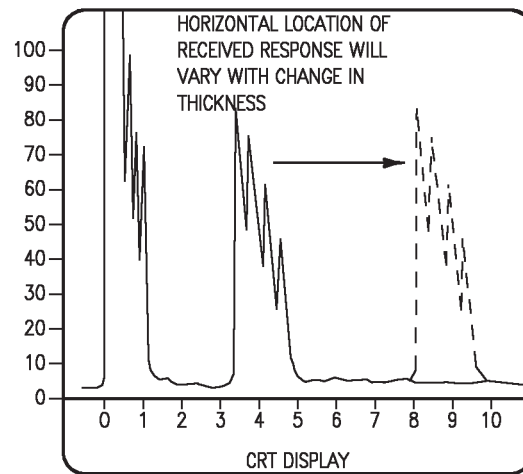
GRAPHITE EPOXY

FLAT BOTTOM HOLE REFERENCE  
STANDARD FOR LAMINATES TO  
0.450 INCH.

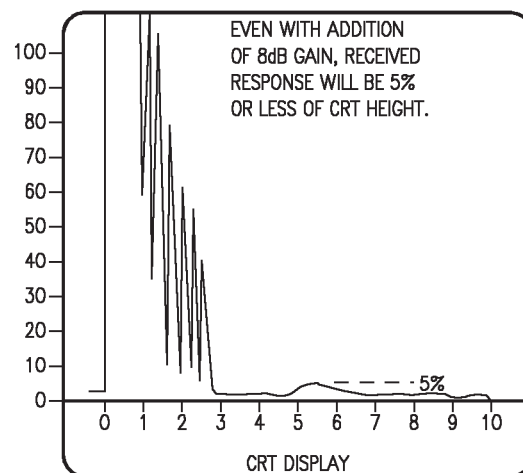
Figure 8. FBH Reference Standard For Solid Laminate Setup



**Figure 9. Inspection Responses For Solid Composite Laminate and Former Areas Greater Than 0.190 (Sheet 1)**



CRT 2



CRT 3

TYPICAL DELAMINATION RESPONSE

Figure 9. Inspection Responses For Solid Composite Laminate and Former Areas Greater Than 0.190 (Sheet 2)

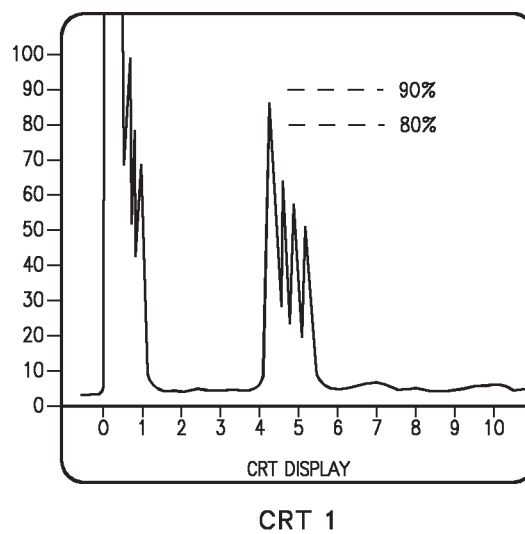
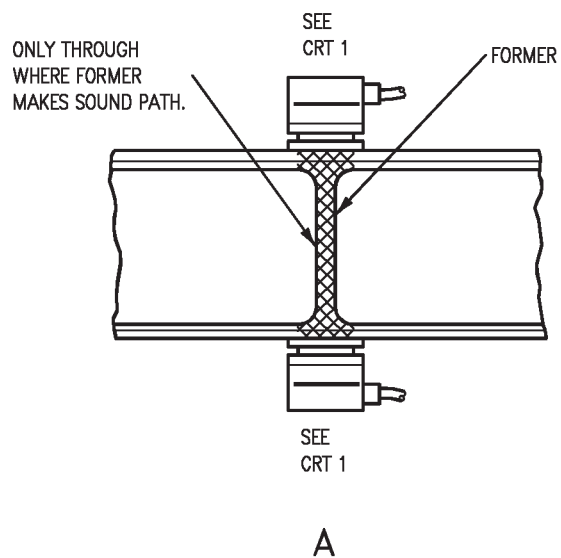
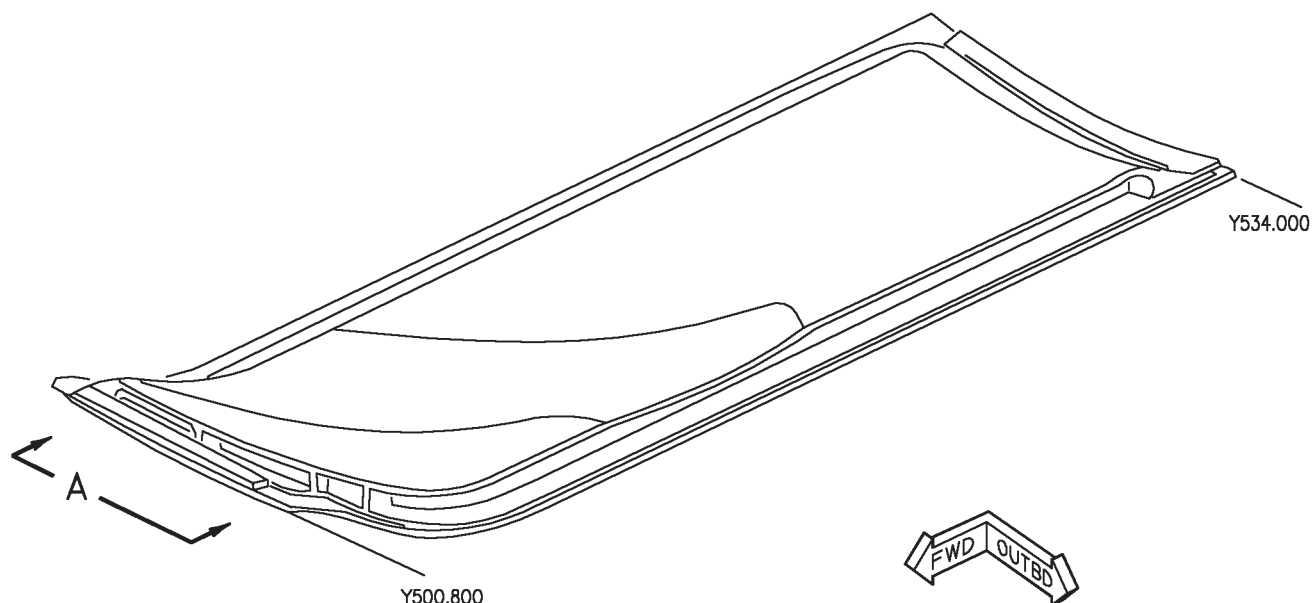


Figure 10. Inspection Responses for Thick Laminate Areas

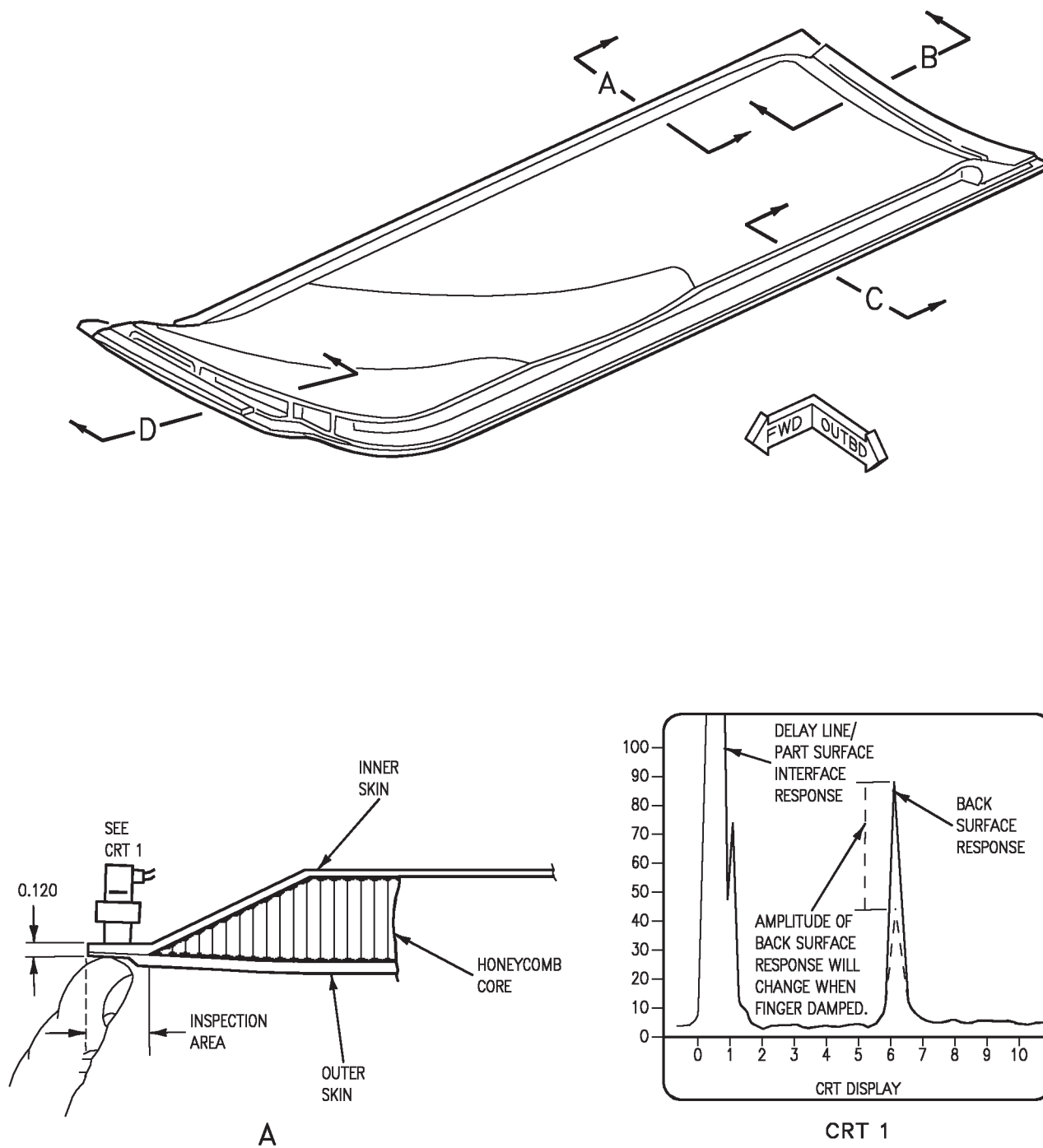


Figure 11. Good Bond Responses (Sheet 1)

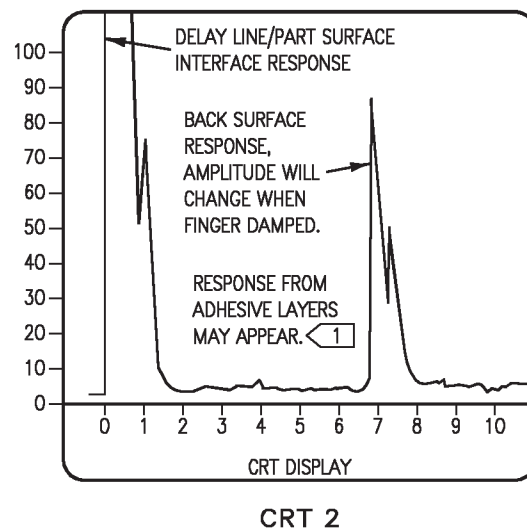
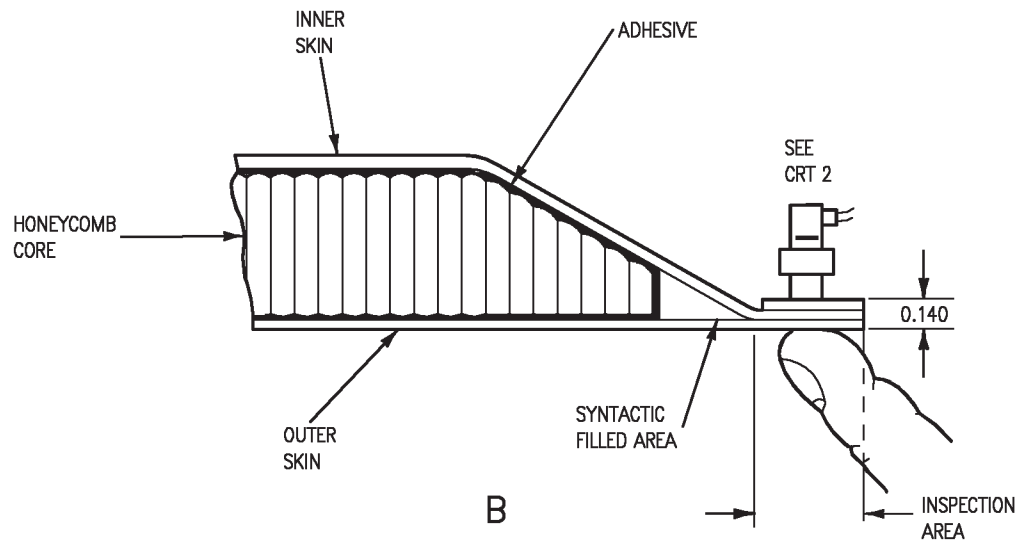
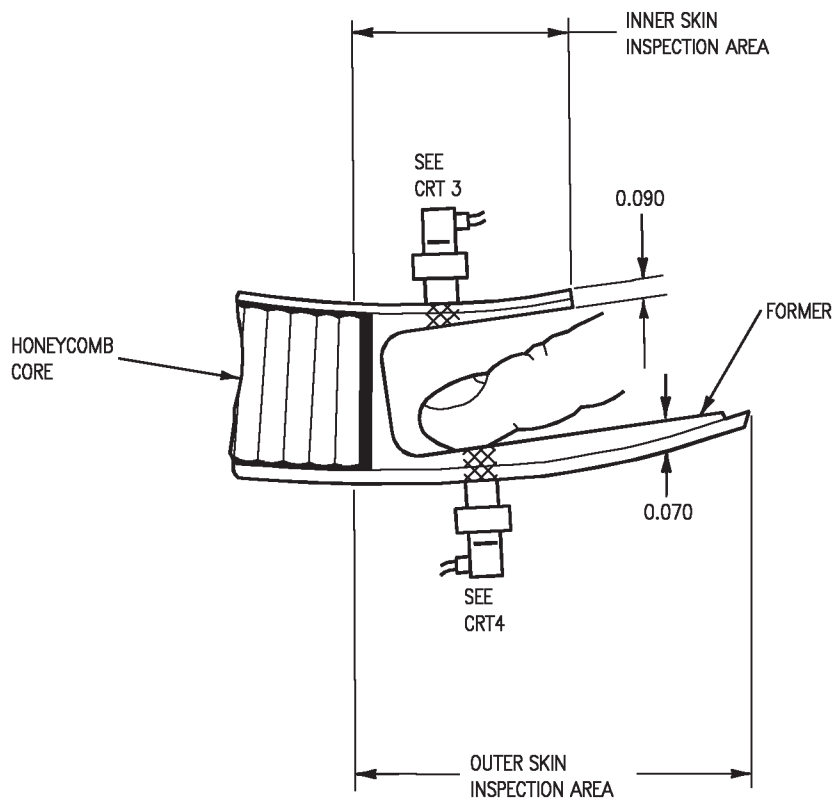
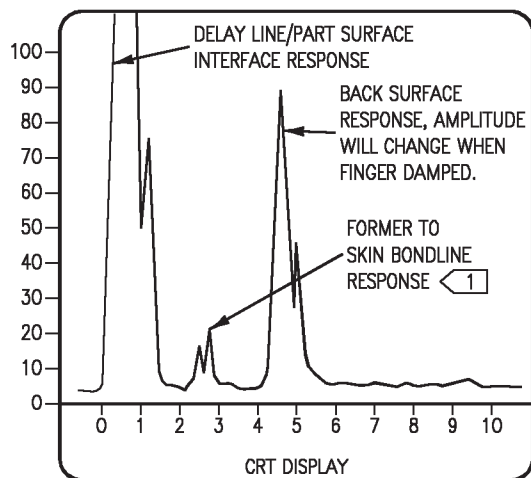


Figure 11. Good Bond Responses (Sheet 2)

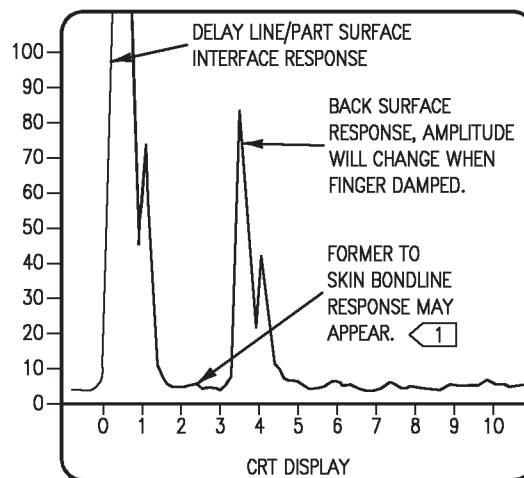




C

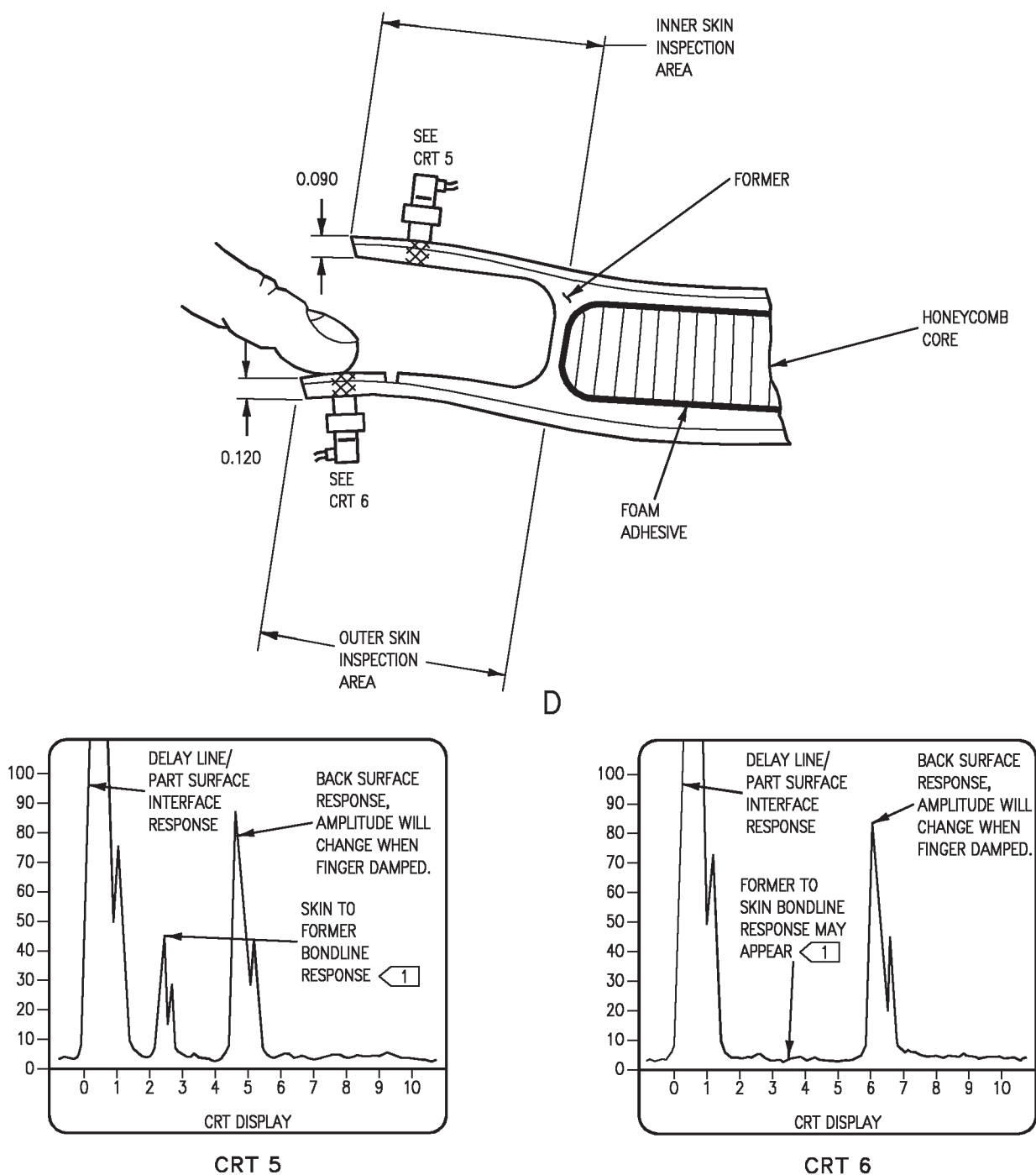


CRT 3



CRT 4

Figure 11. Good Bond Responses (Sheet 3)



## LEGEND

- 1 AMPLITUDE AND LOCATION OF RESPONSE MAY DIFFER FROM DISPLAY SHOWN, BUT WILL NOT CHANGE WHEN BACK SURFACE IS DAMPED.

Figure 11. Good Bond Responses (Sheet 4)

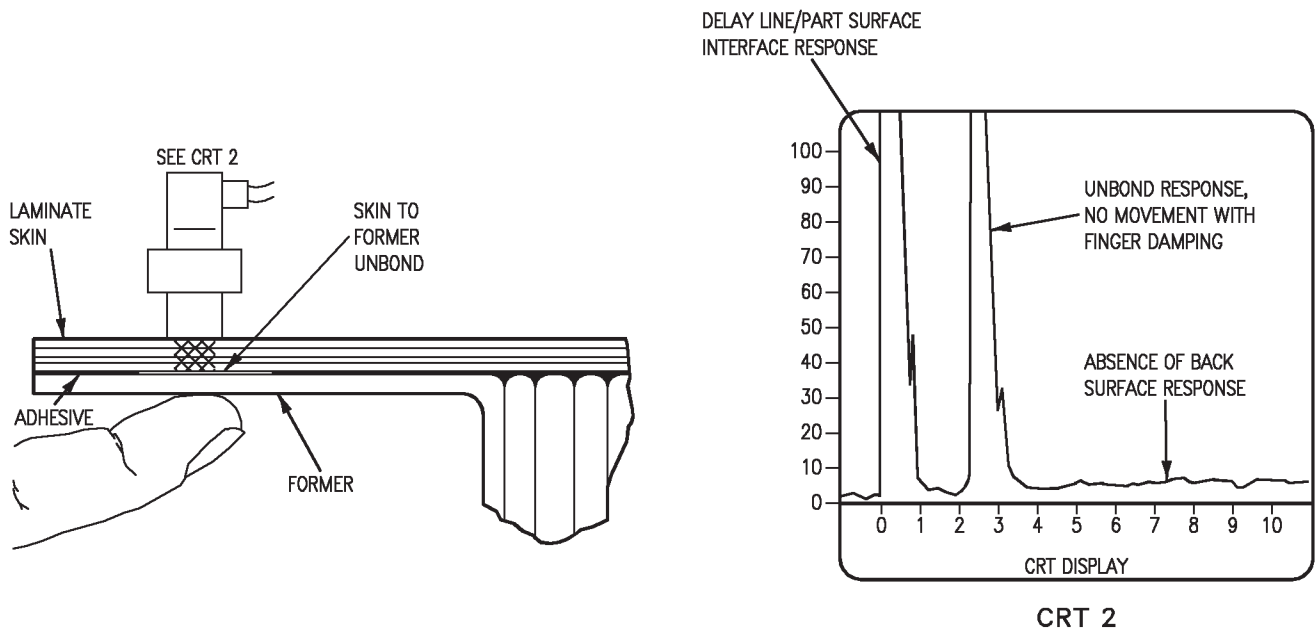
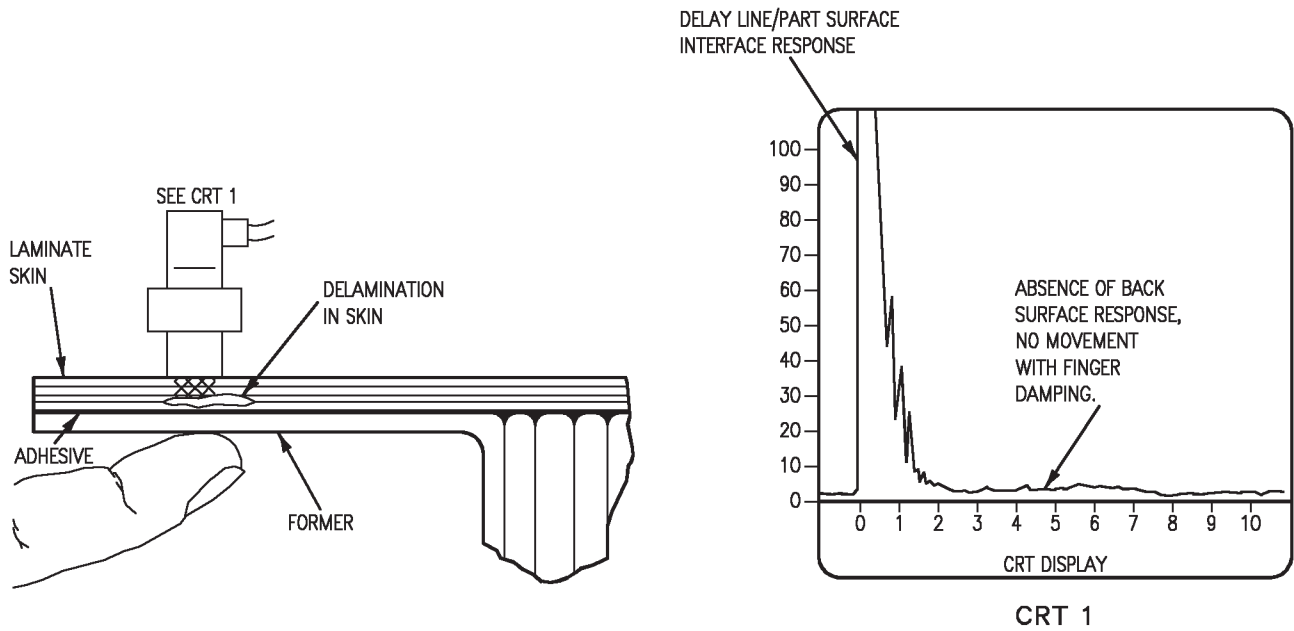


Figure 12. Unbond Responses (Sheet 1)

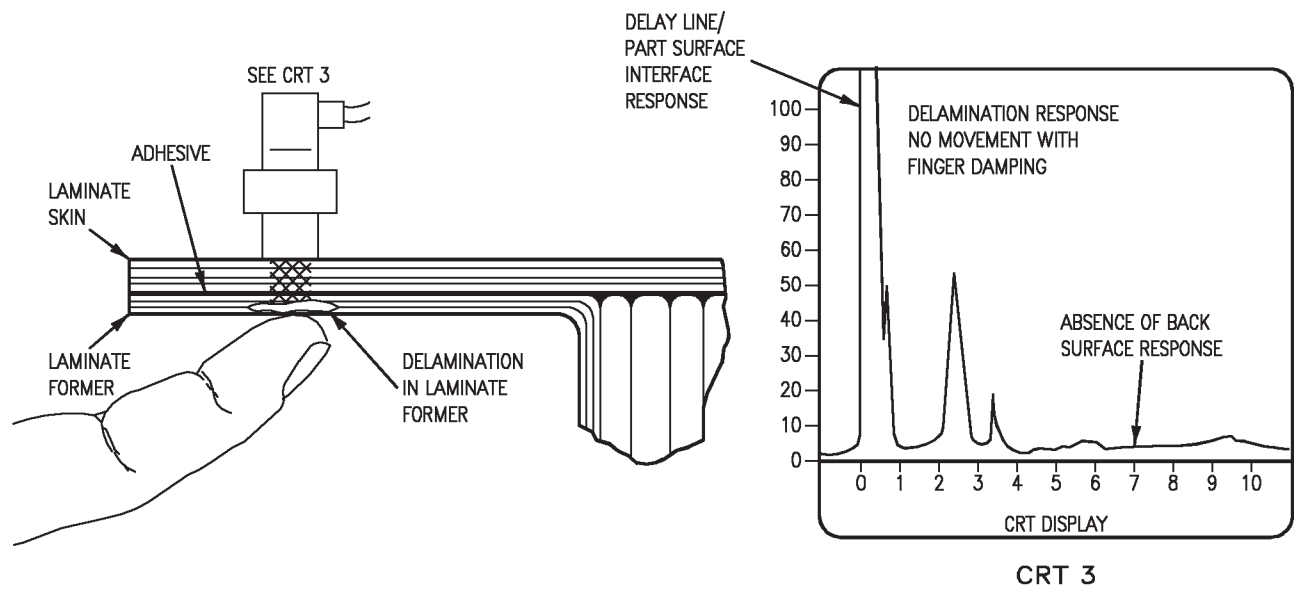


Figure 12. Unbond Responses (Sheet 2)

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**INTERMEDIATE MAINTENANCE****NONDESTRUCTIVE INSPECTION****MAIN LANDING GEAR INBOARD DOOR****SKIN TO CORE UNBONDS AND EDGE DELAMINATIONS****PART NO. 74A426030****This WP supersedes WP076 02, dated 15 December 1992.**

---

**Reference Material**

Naval Aviation Maintenance Program .....	OPNAVINST 4790.2
Plane Captain Manual .....	A1-F18AC-PCM-000
Nondestructive Inspection.....	A1-F18AC-SRM-300
General Information .....	WP003 00
Ultrasonic Through Transmission Contact Testing, Standardization, and Inspection Procedures for Composite Laminate Skin Bonded to Honeycomb Core.....	WP008 01
Pulse-Echo, Longitudinal Wave Contact, With Delay Line, for Composite Material .....	WP008 03
Pulse-Echo, Longitudinal Wave Contact, With Delay Line, for Composite Laminate Material Bonded to Honeycomb Core .....	WP008 04
Ultrasonic Through Transmission Contact Testing, Standardization and Inspection Procedures for Composite Laminate and Metallic Skins Bonded to Honeycomb Core .....	WP008 10
Pulse-Echo Longitudinal, Contact, With Delay Line, for Composite Laminate Materials.....	WP008 12
Pulse-Echo Longitudinal, Contact, With Delay Line, for Composite Laminate Material Bonded to Honeycomb Core .....	WP008 13

**Alphabetical Index**

<b>Subject</b>	<b>Page No.</b>
Main Landing Gear Inboard Door.....	2
Defects .....	2
Post Inspection Cleaning and Corrosion Control.....	5
Primary Inspection Method .....	2
Ultrasonic Method Using C-398 Ultrasonic Flaw Detector .....	2
Ultrasonic Method Using MXU-715/E Ultrasonic Flaw Detector .....	4

**Record of Applicable Technical Directives**

None

## 1. MAIN LANDING GEAR INBOARD DOOR.

2. Main landing gear inboard door, see figures 1 and 2, is bonded honeycomb core assembly. Honeycomb core is 5056 aluminum alloy, F80, flexible core. Structure enclosing core is graphite epoxy and titanium. Skins are graphite epoxy composite laminate. Skin to core bonds are made with FM-300 film adhesive. Core to core, structure to core, and stuffed core bonds are made with foaming adhesive. Surface finish is epoxy primer and polyurethane coatings.

3. **DEFECTS.** Inspect for skin to core unbonds and edge delaminations. Examples of skin to core unbonds and delaminations are contained in (WP003 00).

4. **PRIMARY INSPECTION METHOD.** Primary inspection methods are ultrasonic through transmission and pulse-echo.

5. **Personnel Qualifications.** Personnel doing this nondestructive inspection shall be qualified and certified to do ultrasonic inspections per OPNAVINST 4790.2 SERIES, NDI Technicians, NEC 7225/MOS 6044.

6. **Preparation of Aircraft.** No special preparation required.

7. **Access.** No special access required.

8. ULTRASONIC METHOD USING C-398  
ULTRASONIC FLAW DETECTOR.

## Support Equipment Required

## NOTE

Alternate item type designations or part numbers are listed in parentheses.

Part Number or  
Type Designation

## Nomenclature

C-398 (303B)

Ultrasonic Flaw  
Detector57A2271 or  
EQUIVALENTMicrodot to BNC  
Connecting Cable,  
2 Reqd.Support Equipment Required  
(Continued)Part Number or  
Type Designation

## Nomenclature

57A2276 or  
EQUIVALENT0°, 0.500 Dia.,  
2.25 MHz, Contact  
Search Unit,  
2 Reqd.

GD0504

0°, 0.25 Dia., 5 MHz,  
Delay Line Contact  
Search Unit

74D110175-1001

Graphite Epoxy Refer-  
ence Standard Set  
Containing the  
Following:

74D111295-1009

Graphite Epoxy Flat  
Bottom Hole  
Reference Standard  
for Laminates up to  
0.450 Inch

74D111295-1005

Honeycomb Reference  
Standard With  
Graphite Epoxy  
Skins for Sandwich  
Assemblies Less  
Than 1 Inch

## Materials Required

## NOTE

Alternate item specifications or part numbers are shown indented.

Specification  
or Part Number

## Nomenclature

ULTRAGEL II or  
EQUIVALENT

Couplant

MIL-P-83993-2, TYPE  
1, CLASS A or B,  
RED or BLACK

Aircraft Marking Pencil

P-D-680 TYPE 2  
D 1153Dry Cleaning Solvent  
Methyl Isobutyl  
KetoneCCC-C-46, TYPE 1,  
CLASS 4

Cleaning Cloth

**WARNING**

Dry cleaning solvent and methyl isobutyl ketone are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

9. **Preparation of Part.** Clean inner and outer surfaces of inspection area with solvent moistened cloth to make sure part is free of contamination or foreign matter.

**WARNING**

Make sure safety precautions have been met for electrical, static, grounding when using ultrasonic equipment near aircraft fuel cells, oxygen systems, electronic systems, and stores (A1-F18AC-PCM-000).

10. **Equipment Settings/Standardization/Setup for Skin to Core and Thick Laminate Areas.** See figures 3, 4, and 5. Do standardization per (WP008 01), and as below:

- a. Use two 57A2276 search units.
- b. Use P-1 calibration point on 74D111295-1005 graphite/epoxy skinned honeycomb core sandwich assembly reference standard.

11. **Inspection Procedure for Skin to Core and Thick Laminate Areas.** See figures 6, 7, 8, and 9. After standardization, inspect skin to core area of door per (WP008 01), except as below:

- a. Use two 57A2276 search units.
- b. Apply couplant to both surfaces of inspection area(s).
- c. Make sure initial pulse width does not interfere with location of received response. If required, switch position of search units on microdot cables or use different search unit on receiver cable.
- d. Inspect thick laminate areas of formers as shown in figure 10.

e. Use ultrasonic pulse-echo per (WP008 04) to determine if suspect areas are result of skin delaminations. Do pulse-echo inspection on both surfaces to help identify location of flaws causing through transmission unbond response.

**WARNING**

12. **Equipment Setting/Standardization/Setup for Thin Laminate and Skin to Structure Areas.** See figures 11 and 12. Do standardization for thin laminates and skin to structure areas per (WP008 03), making sure trailing edge of initial pulse is located at less than 1 large division when 0.100 inch FBH response is 80 to 90 percent CRT height.

13. **Inspection procedure for Thin Laminate and Skin to Structure Areas.** Inspect thin laminate and skin to structure areas per (WP008 03) and following:

- a. Apply couplant to solid laminate inspection area where laminate thickness is known.
- b. Make sure leading edge of back surface response is located at correct location on horizontal baseline when peak amplitude is 80 to 90 percent CRT height.
- c. Scan area to be inspected, finger damping back surface response as often as required to make sure correct response is being received. Finger damp by placing couplant on end of finger and touching opposite surface. As finger touches and is removed from part surface, reflected response on CRT will move up and down as it is damped, indicating good bond.
- d. For inspection responses in addition to those described in (WP008 03), refer to figures 11, for good response, and 12, for unbond responses.

e. Use pulse-echo mapping techniques per (WP008 03) to determine extent of flaw indication.

f. Do paragraph 20.

#### 14. ULTRASONIC METHOD USING MXU-715/E ULTRASONIC FLAW DETECTOR.

##### Support Equipment Required

Part Number or Type Designation	Nomenclature
1642AS100-1	Ultrasonic Flaw Detector, MXU-715/E, Magnaflux
57A2271 or EQUIVALENT	Microdot to BNC Connecting Cable, 2 Req'd.
57A2276 or EQUIVALENT	0°, 0.500 Dia., 2.25 MHz, Contact Search Unit, 2 Req'd.
GD0504	0°, 0.25 Dia., 5 MHz, Delay Line Contact Search Unit
74D110175-1001	Graphite Epoxy Refer- ence Standard Set Containing the Following:
74D111295-1009	Graphite Epoxy Flat Bottom Hole Reference Standard for Laminates up to 0.450 Inch
74D111295-1005	Honeycomb Reference Standard With Graphite Epoxy Skins for Sandwich Assemblies Less Than 1 Inch

##### Materials Required

###### NOTE

Alternate item specifications or part numbers are shown indented.

Specification or Part Number	Nomenclature
ULTRAGEL II or EQUIVALENT	Couplant

##### Materials Required (Continued)

###### NOTE

Alternate item specifications or part numbers are shown indented.

MIL-P-83993-2, TYPE 1, CLASS A or B, RED or BLACK	Aircraft Marking Pencil
P-D-680 TYPE 2 D 1153	Dry Cleaning Solvent Methyl Isobutyl Ketone
CCC-C-46, TYPE 1, CLASS 4	Cleaning Cloth

###### WARNING

Dry cleaning solvent and methyl isobutyl ketone are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

15. **Preparation of Part.** Clean inner and outer surfaces of inspection area with solvent moistened cloth to make sure part is free of contamination or foreign matter.

###### WARNING

Make sure safety precautions have been met for electrical, static, grounding when using ultrasonic equipment near aircraft fuel cells, oxygen systems, electronic systems, and stores  
(A1-F18AC-PCM-000).

16. **Equipment Settings/Standardization/Setup for Skin to Core and Thick Laminate Areas.** Do standardization per (WP008 10), and as below:

a. Use two 57A2276 search units.

b. Use P-1 calibration point on 74D111295-1005 graphite/epoxy skinned honeycomb core sandwich assembly reference standard.



**17. Inspection Procedure for Skin to Core and Thick Laminate Areas.** After standardization, inspect skin to core area of door per (WP008 10), except as below:

- a. Use two 57A2276 search units.
- b. Apply couplant to both surfaces of inspection area(s).
- c. Make sure initial pulse width does not interfere with location of received response. If required, switch position of search units on microdot cables or use different search unit on receiver cable.
- d. Inspect thick laminate areas of formers as shown in figure 10.
- e. Use ultrasonic pulse-echo per (WP008 13) to determine if suspect areas are result of skin delaminations. Do pulse-echo inspection on both surfaces to help identify location of flaws causing through transmission unbond response.

## WARNING

**18. Equipment Setting/Standardization/Setup for Thin Laminate and Skin to Structure Areas.** Do standardization for thin laminates and skin to structure areas per (WP008 12), making sure trailing edge of initial pulse is located at less than 1 large division when 0.100 inch FBH response is 80 to 90 percent CRT height.

**19. Inspection procedure for Thin Laminate and Skin to Structure Areas.** Inspect thin laminate and skin to structure areas per (WP008 12) and following:

a. Apply couplant to solid laminate inspection area where laminate thickness is known.

b. Make sure leading edge of back surface response is located at correct location on horizontal baseline when peak amplitude is 80 to 90 percent CRT height.

c. Scan area to be inspected, finger damping back surface response as often as required to make sure correct response is being received. Finger damp by placing couplant on end of finger and touching opposite surface. As finger touches and is removed from part surface, reflected response on CRT will move up and down as it is damped, indicating good bond.

d. For inspection responses in addition to those described in (WP008 12), refer to figures 11, for good response, and 12, for unbond responses.

e. Use pulse-echo mapping techniques per (WP008 12) to determine extent of flaw indication.

## WARNING

Dry cleaning solvent and methyl isobutyl ketone are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

**20. POST INSPECTION CLEANING AND CORROSION CONTROL.** After recording any defects, clean inspection marks and couplant from door(s) with solvent moistened cloth.

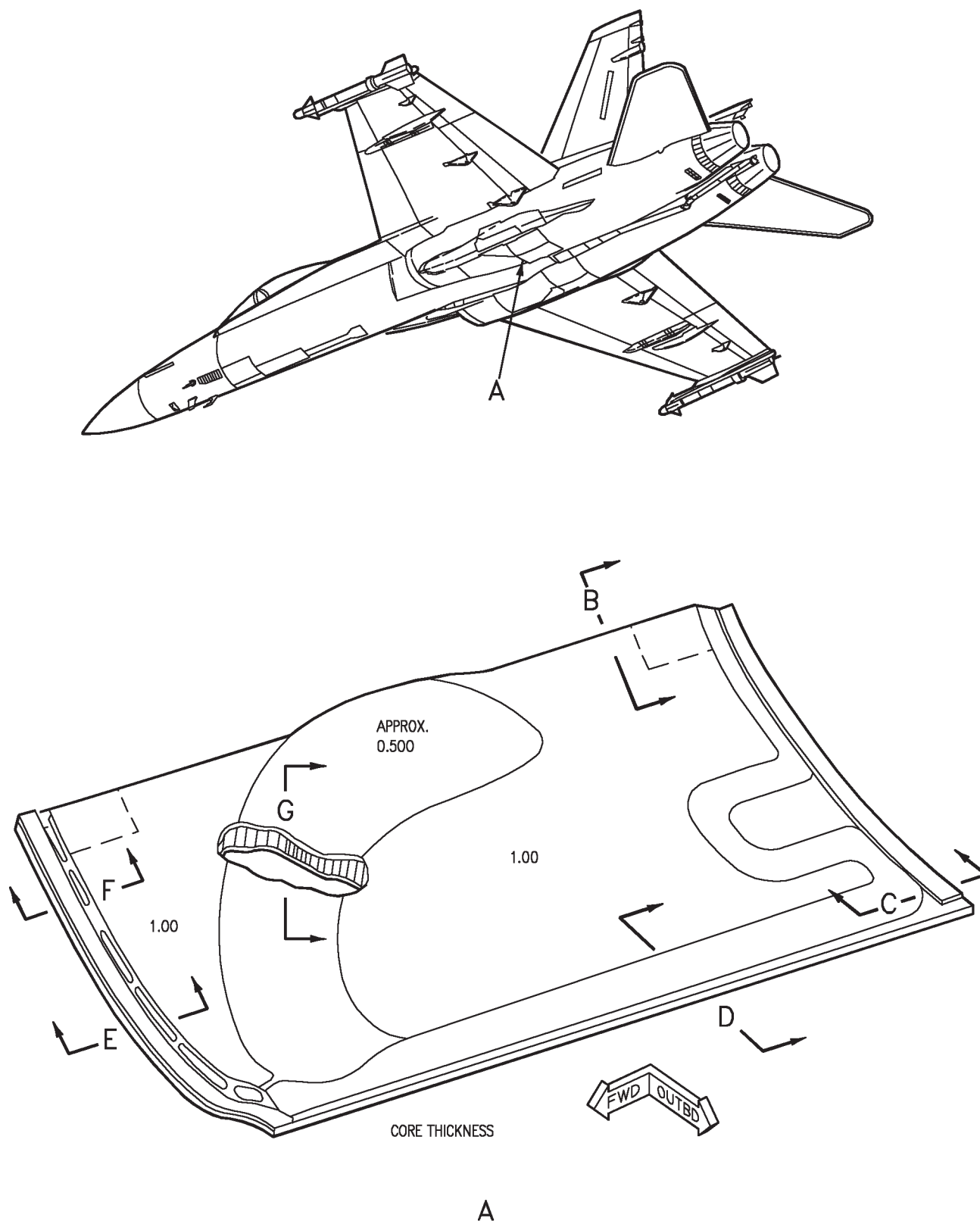


Figure 1. Structure and Core Thickness (Sheet 1)

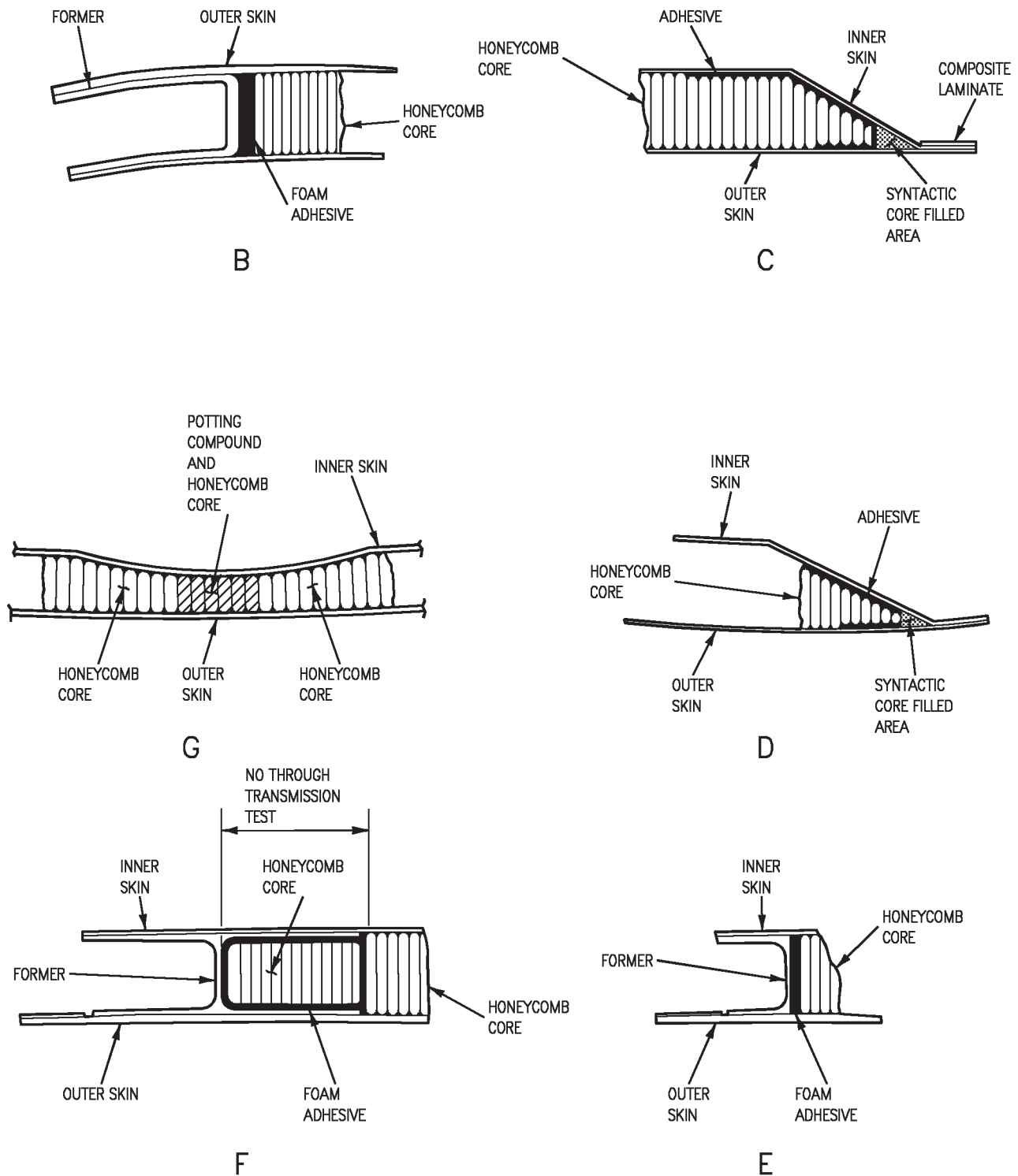
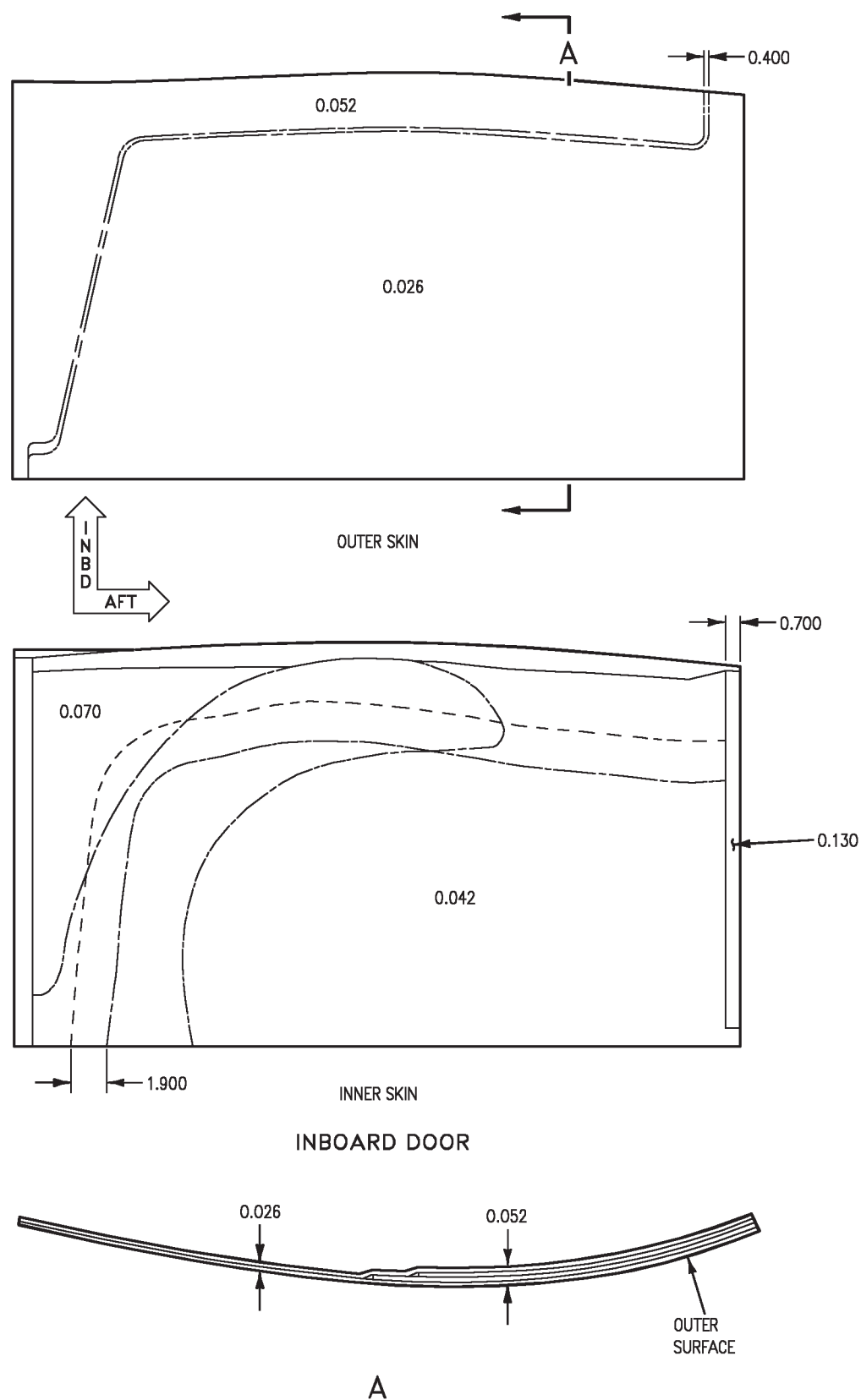
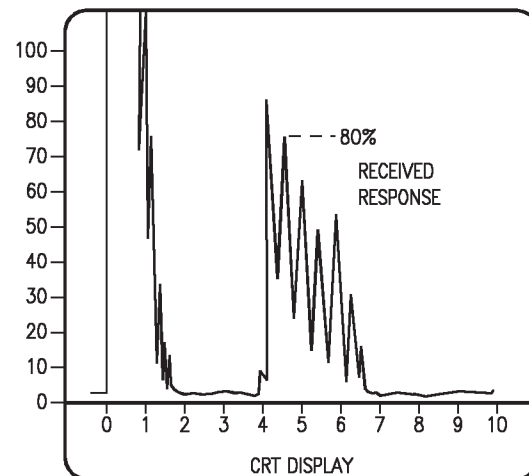
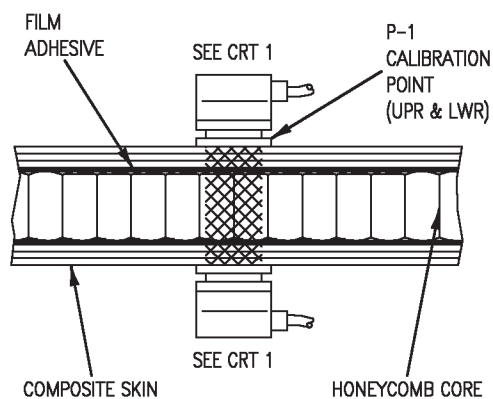


Figure 1. Structure and Core Thickness (Sheet 2)



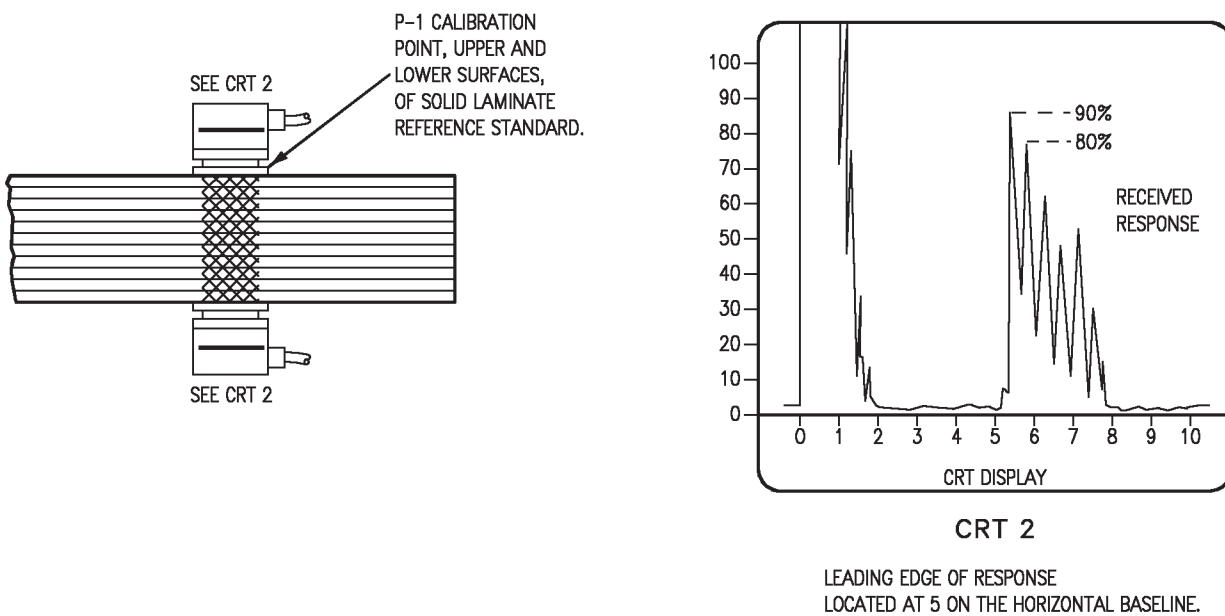
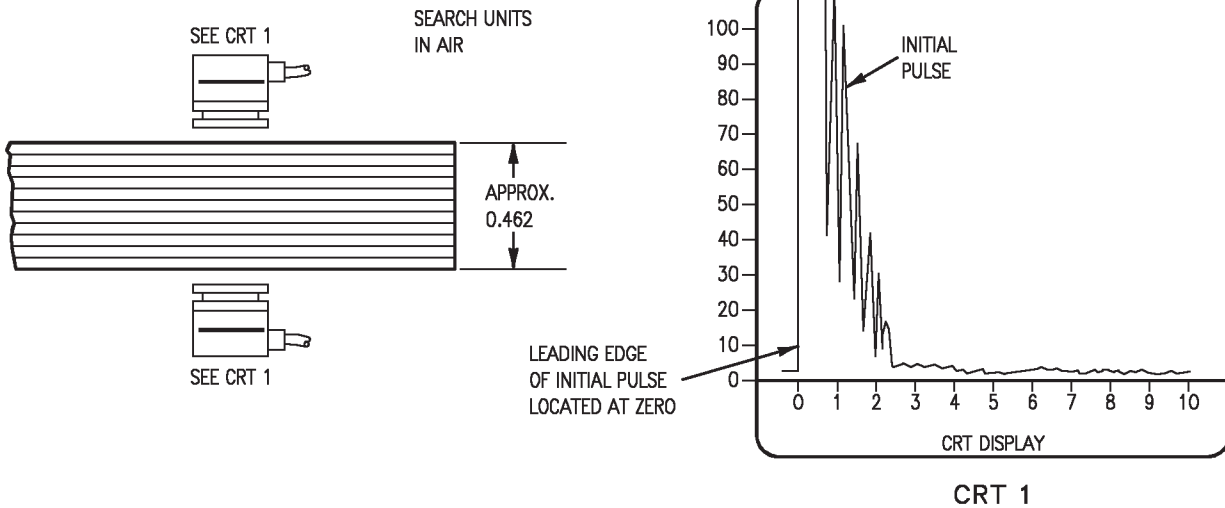
**Figure 2. Typical Skin Thickness**



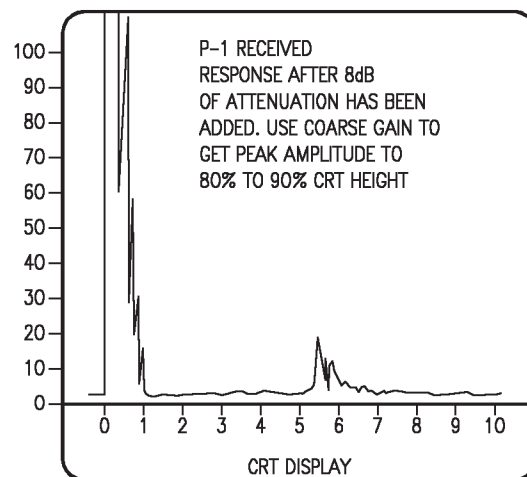
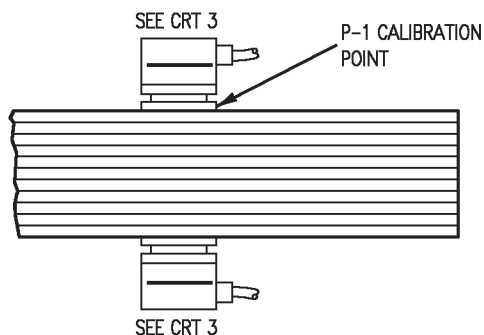
CRT 1

LEADING EDGE OF RECEIVED RESPONSE  
LOCATED AT 4 ON THE HORIZONTAL BASELINE.

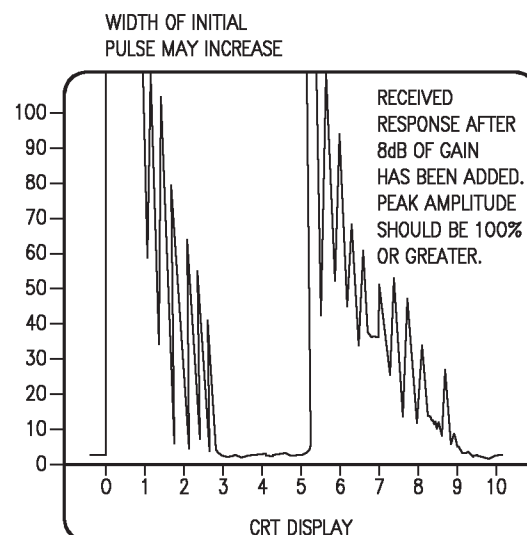
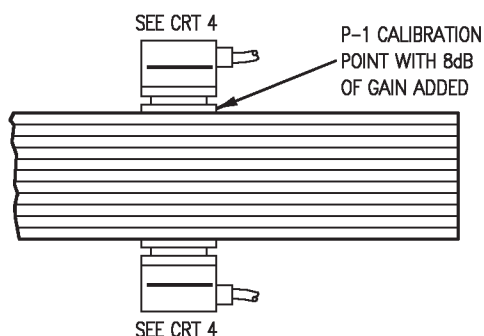
**Figure 3. Standardization on One Half Inch Tall Graphite Epoxy Skinned Honeycomb Core Sandwich Assembly Reference Standard, 74D111295-1005**



**Figure 4. Standardization for Solid Laminate and Former Areas With Thicknesses Greater Than 0.190 (Sheet 1)**



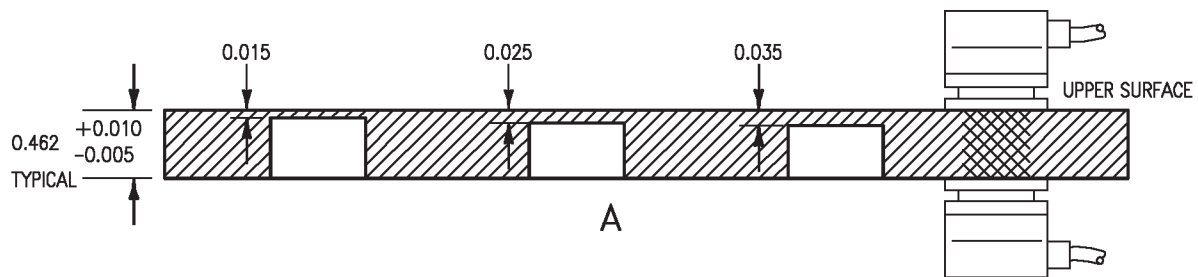
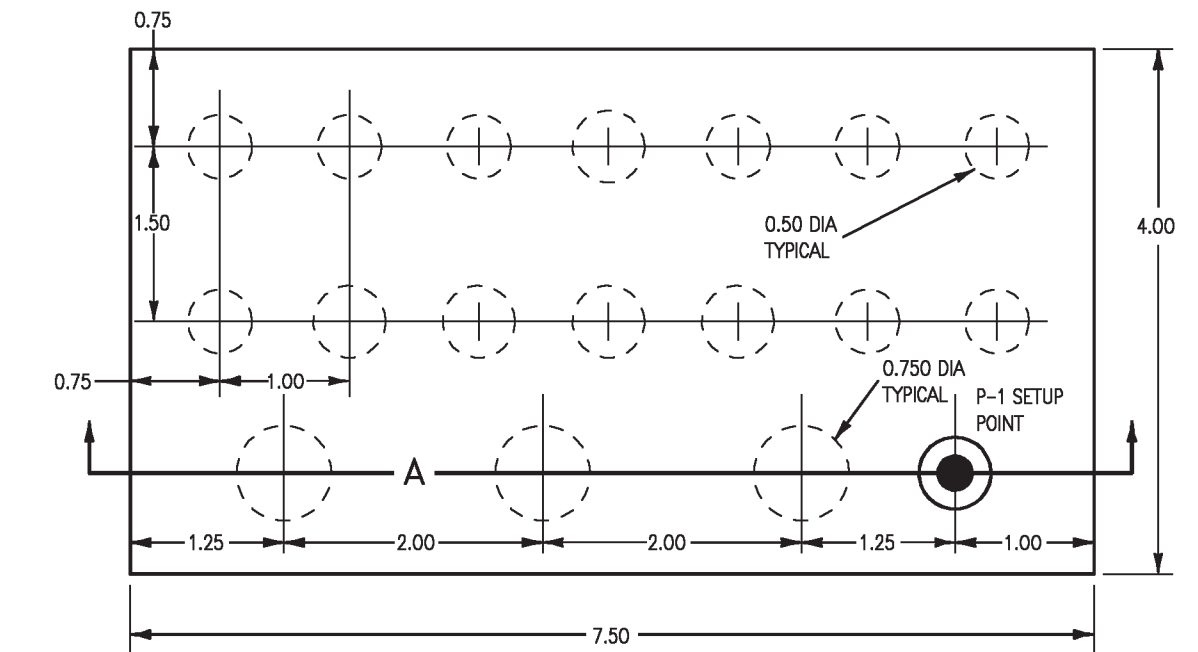
CRT 3



CRT 4

LEADING EDGE OF RECEIVED RESPONSE SHOULD STILL BE LOCATED AT 4.

**Figure 4. Standardization for Solid Laminate and Former Areas With Thicknesses Greater Than 0.190 (Sheet 2)**



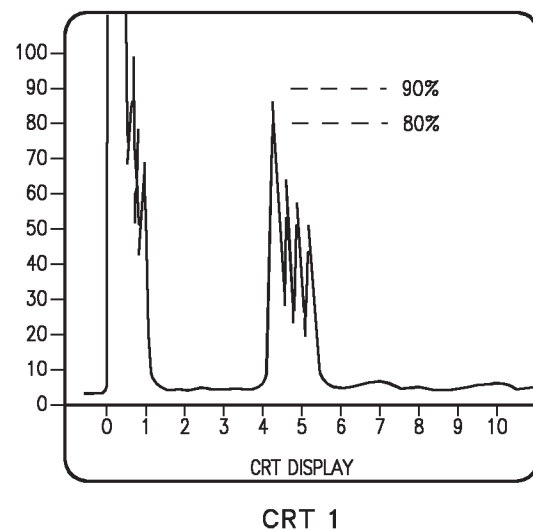
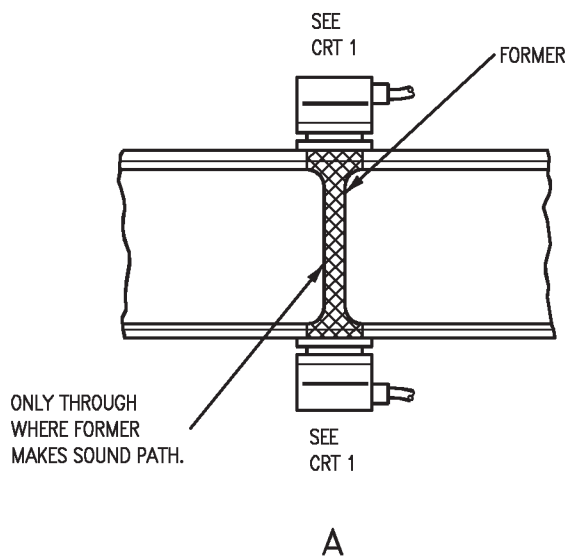
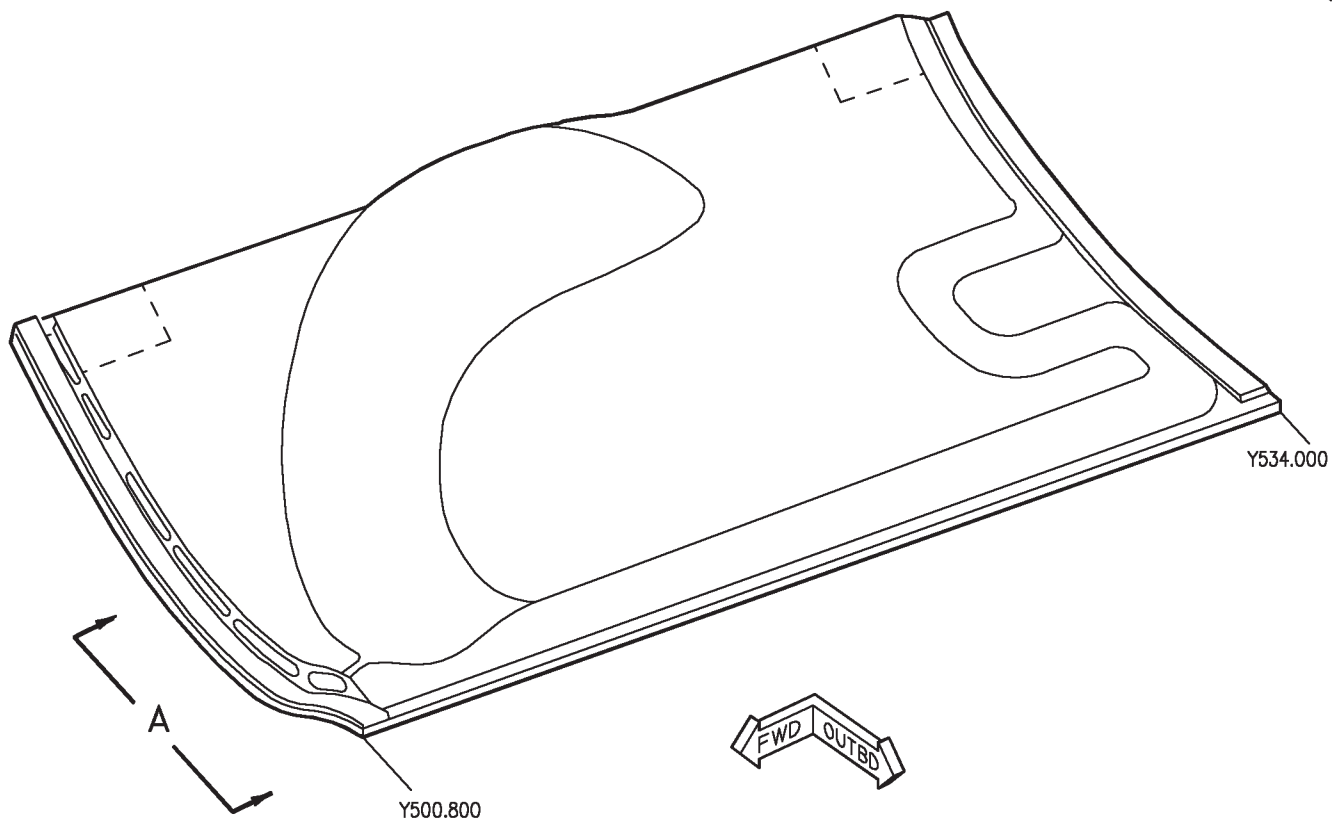
74D111295-1009

GRAPHITE EPOXY

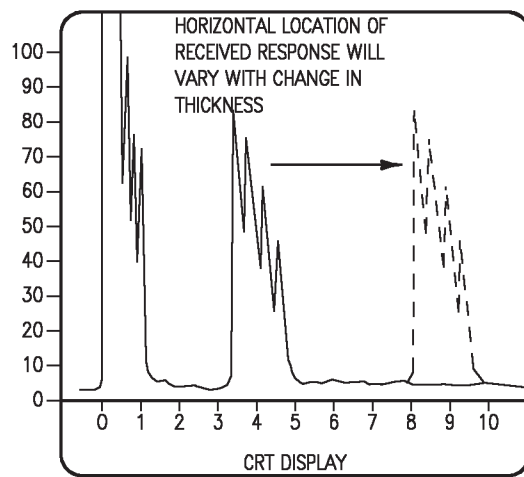
FLAT BOTTOM HOLE REFERENCE  
STANDARD FOR LAMINATES TO  
0.450 INCH.

Figure 5. FBH Reference Standard for Solid Laminate Setup

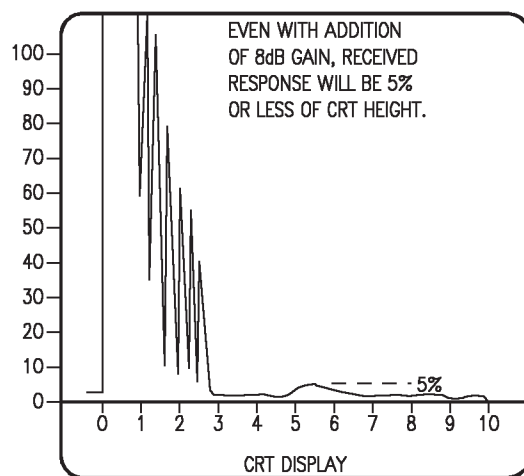




**Figure 6. Inspection Responses for Solid Composite Laminate and Former Areas Greater Than 0.190 (Sheet 1)**



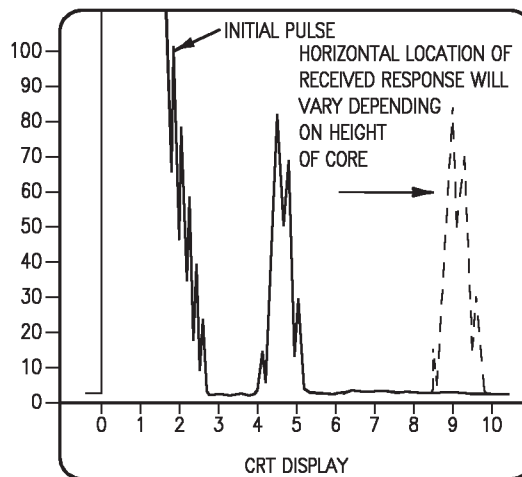
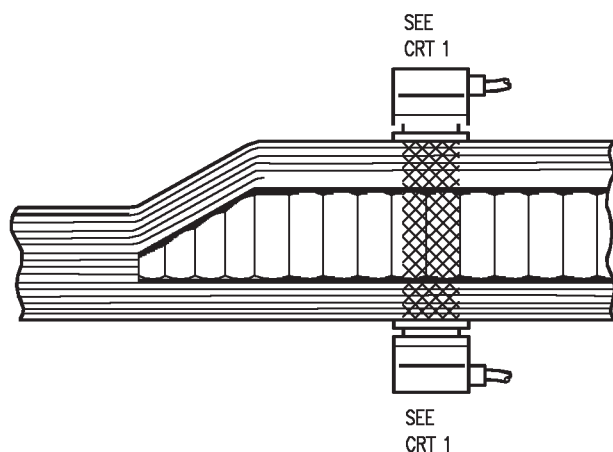
CRT 2



CRT 3

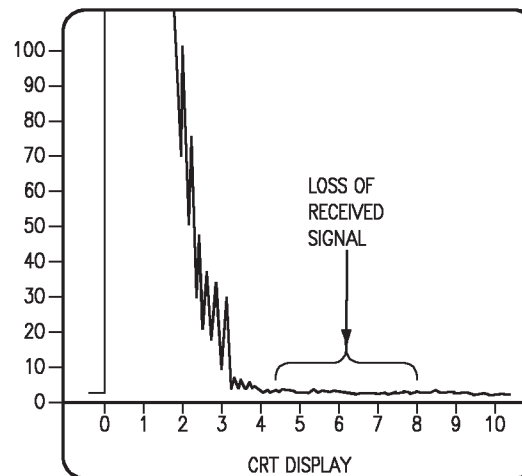
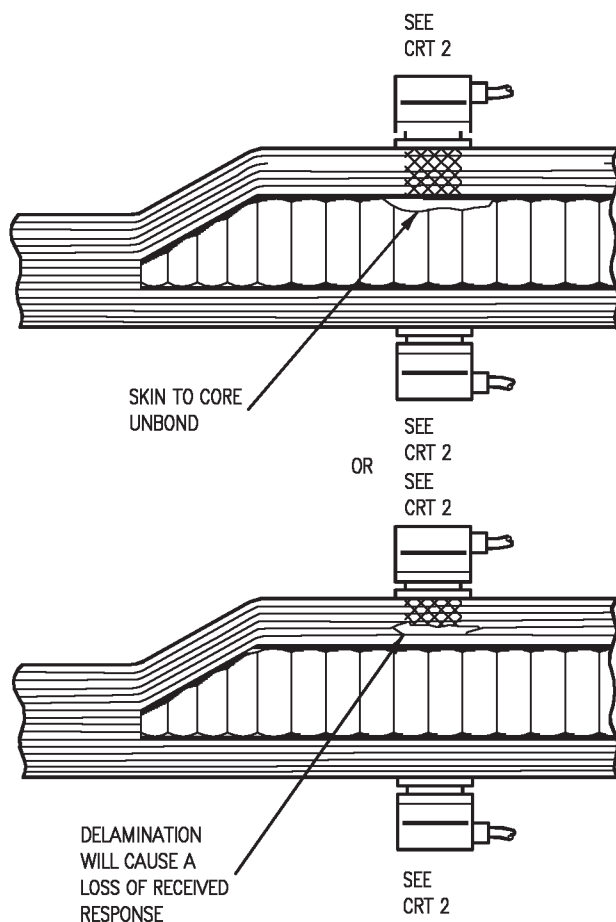
TYPICAL DELAMINATION RESPONSE

Figure 6. Inspection Responses for Solid Composite Laminate and Former Areas Greater Than 0.190 (Sheet 2)



**CRT 1**

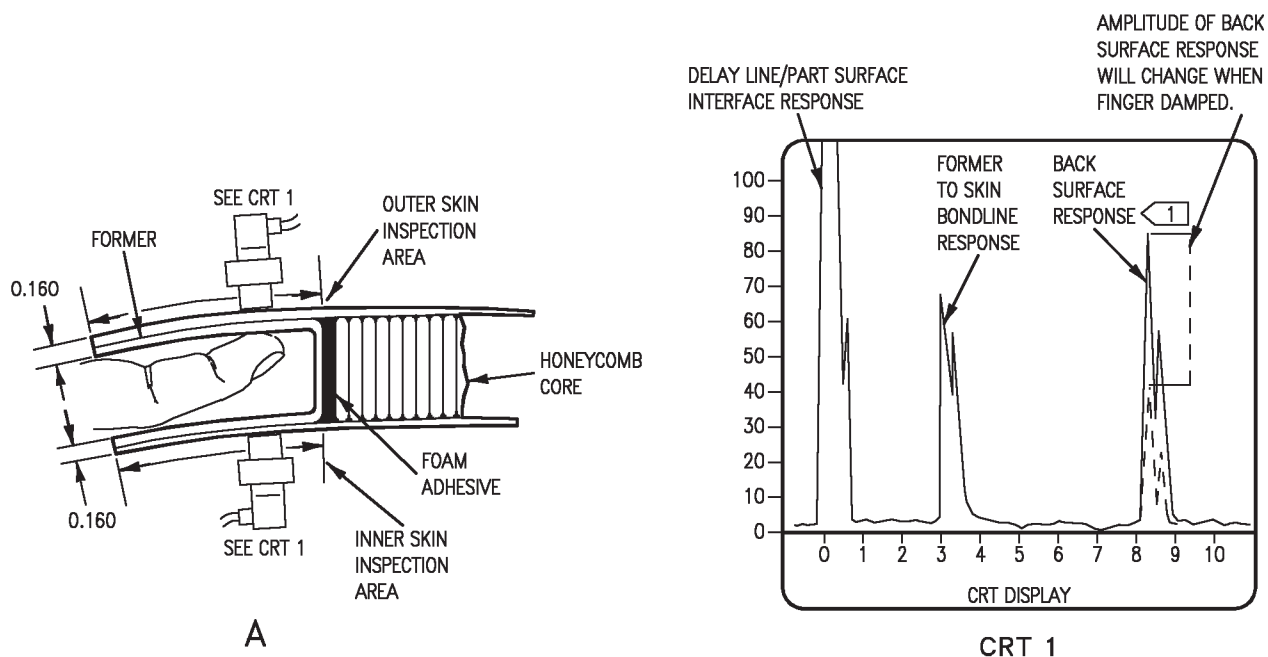
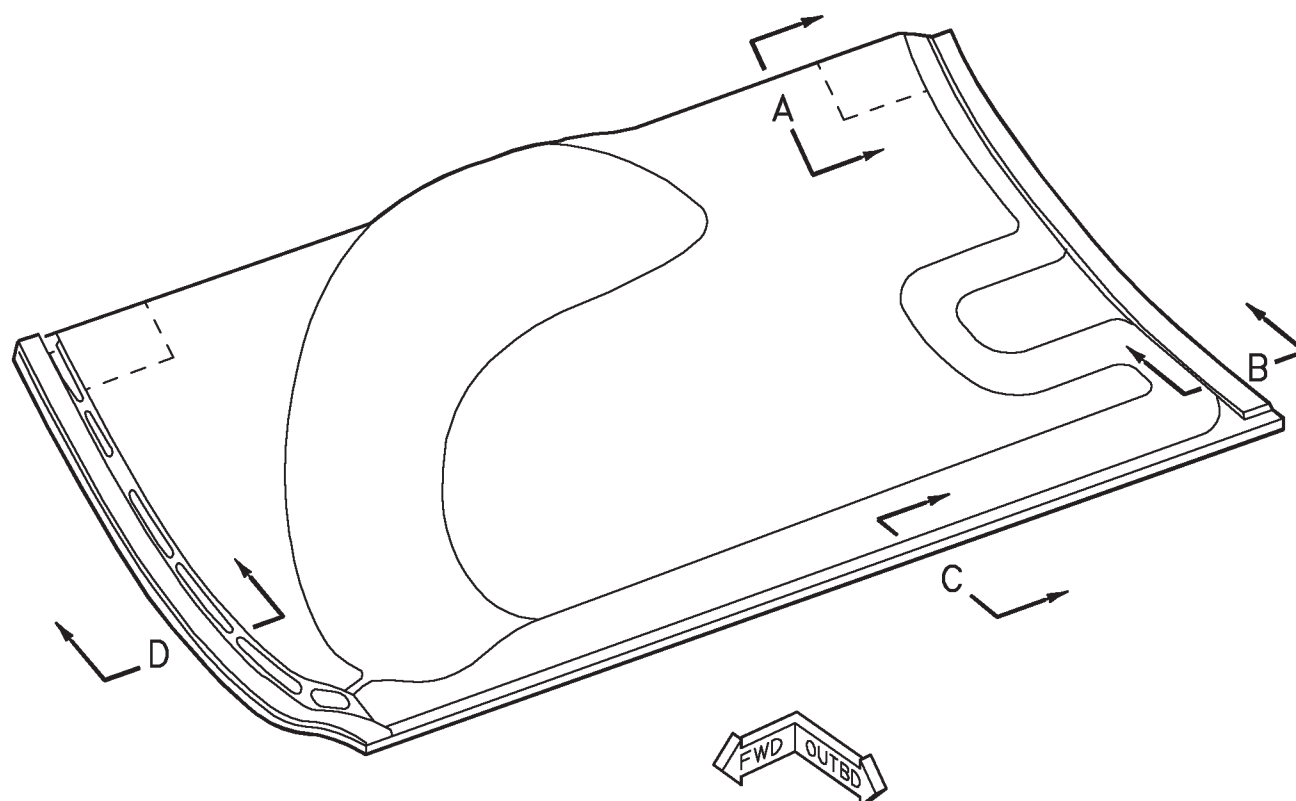
(TYPICAL) SKIN TO CORE  
GOOD BOND RESPONSE



**CRT 2**

(TYPICAL) SKIN TO CORE  
UNBOND RESPONSE

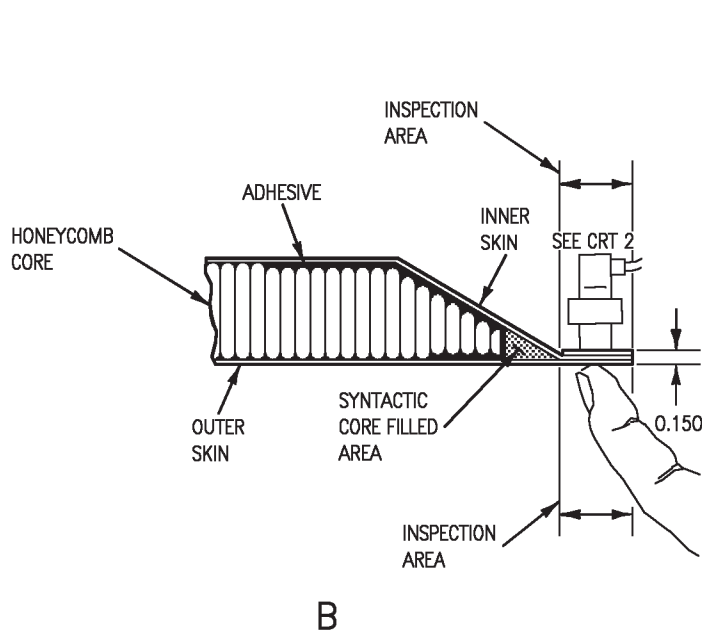
**Figure 7. Honeycomb Core Inspection Responses**



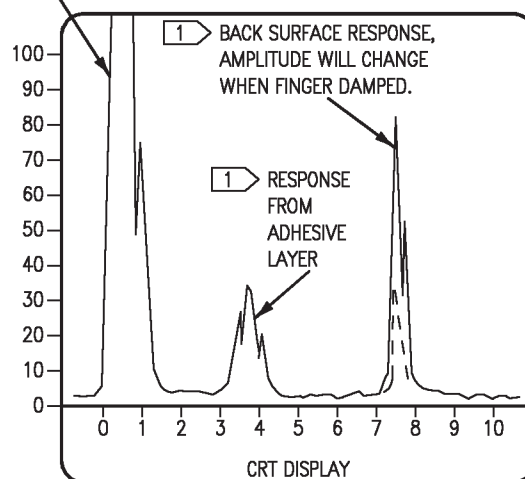
## LEGEND

- 1 AMPLITUDE AND LOCATION OF RESPONSE MAY DIFFER FROM DISPLAY SHOWN, BUT WILL NOT CHANGE WHEN BACK SURFACE IS DAMPED.

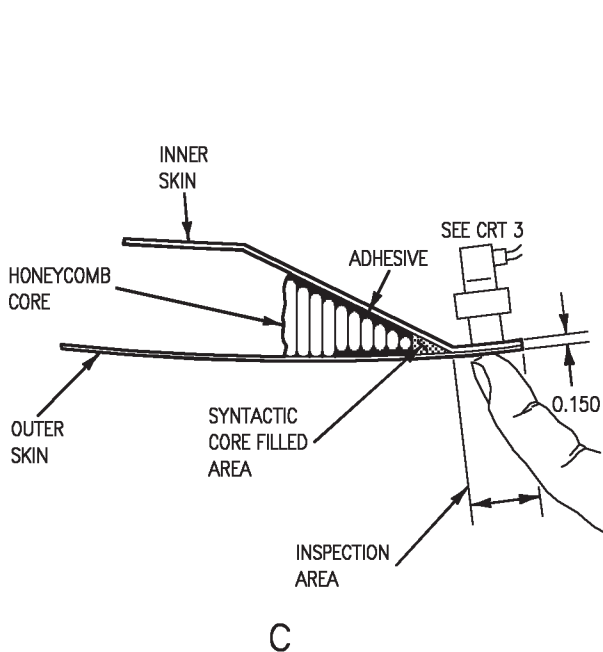
**Figure 8. Inspection Area Thicknesses and Typical Good Responses (Sheet 1)**



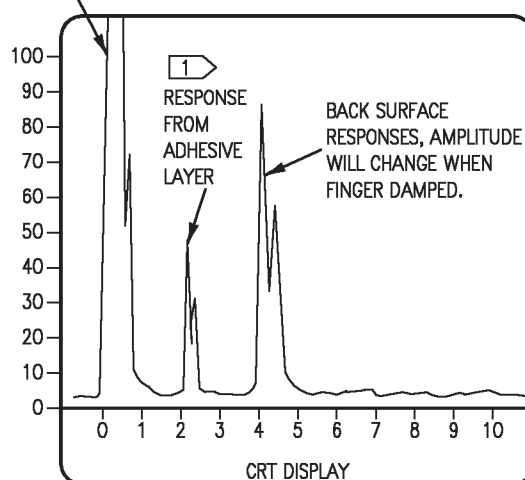
DELAY LINE/PART SURFACE  
INTERFACE RESPONSE



CRT 2

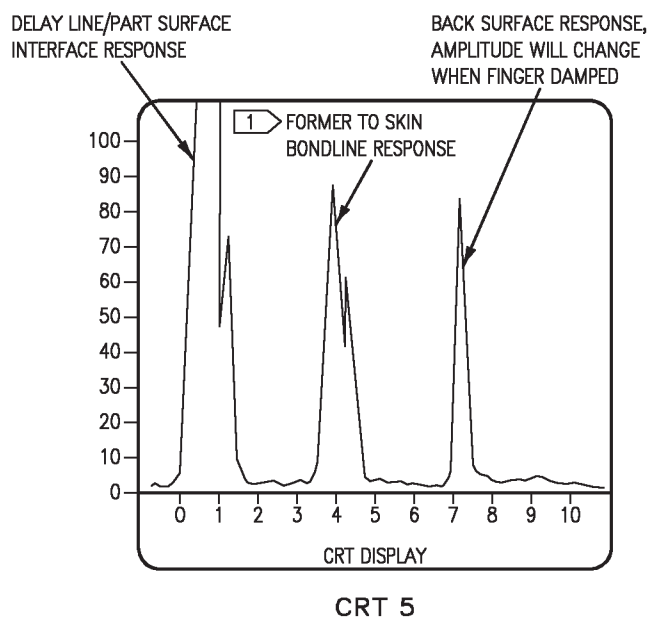
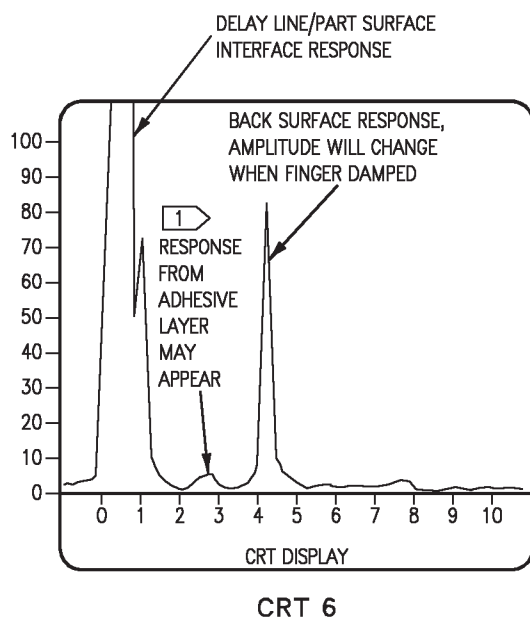
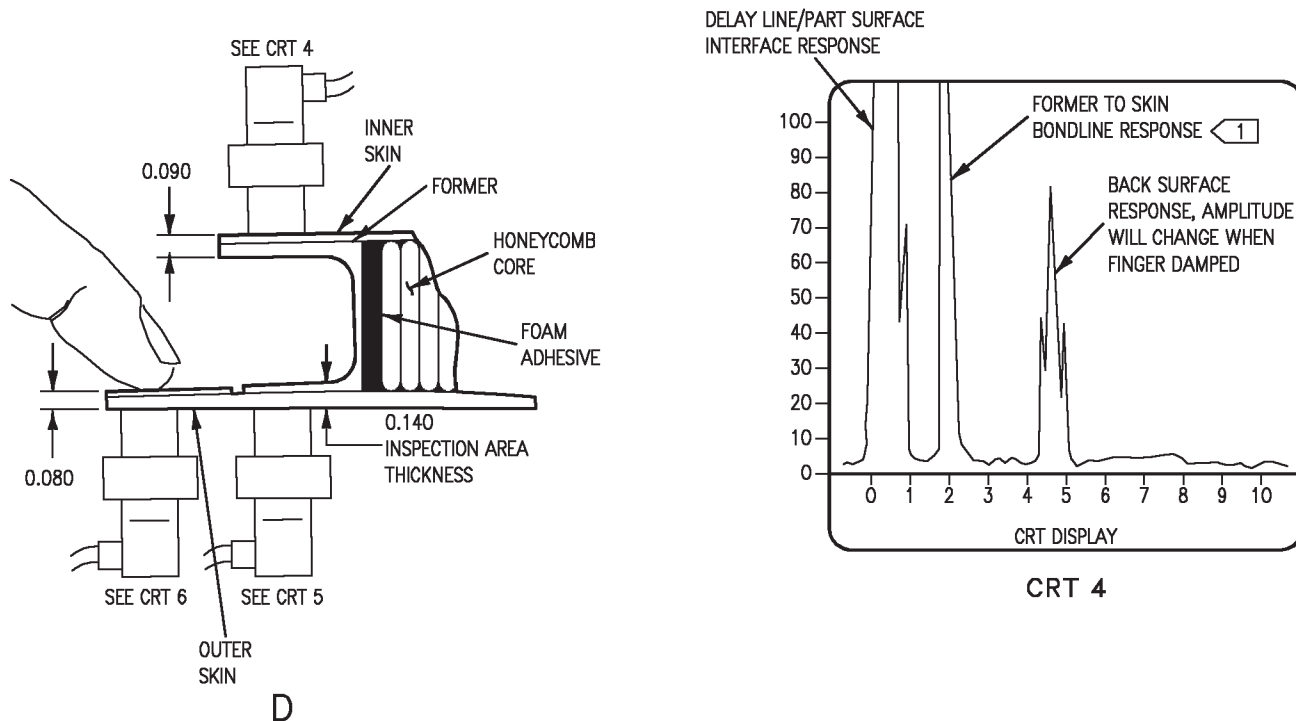


DELAY LINE/PART SURFACE  
INTERFACE RESPONSE



CRT 3

**Figure 8. Inspection Area Thicknesses and Typical Good Responses (Sheet 2)**



## LEGEND

- 1 AMPLITUDE AND LOCATION OF RESPONSE MAY DIFFER FROM DISPLAY SHOWN, BUT WILL NOT CHANGE WHEN BACK SURFACE IS DAMPED.

**Figure 8. Inspection Area Thicknesses and Typical Good Responses (Sheet 3)**

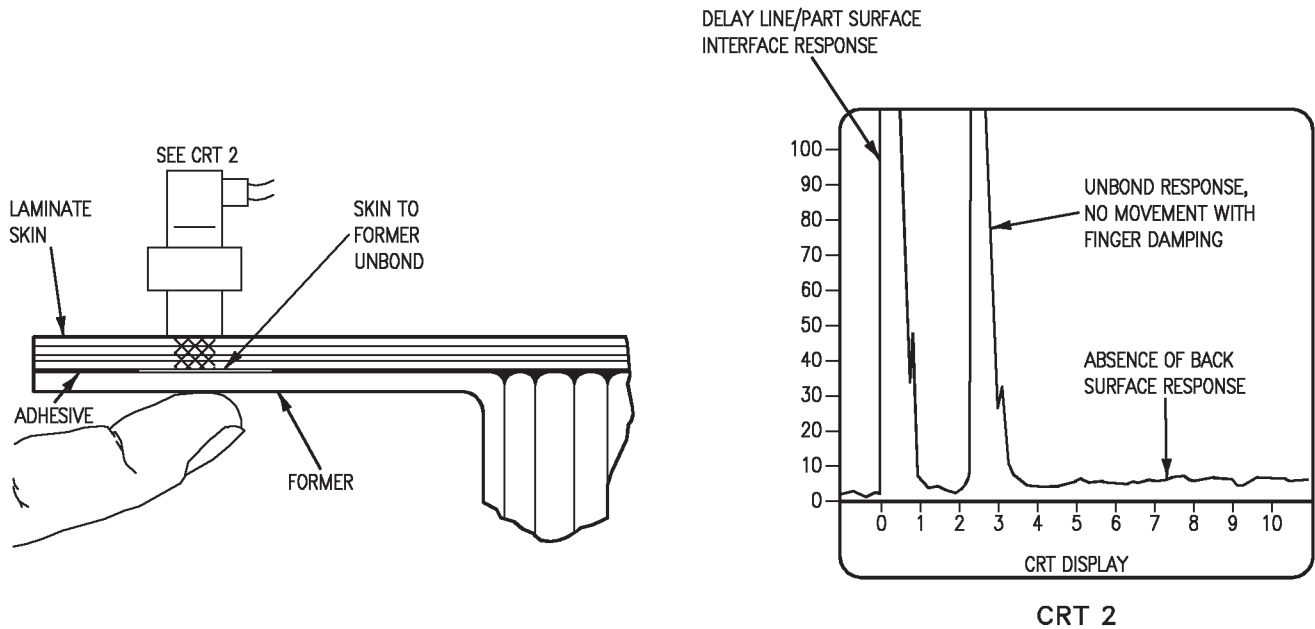
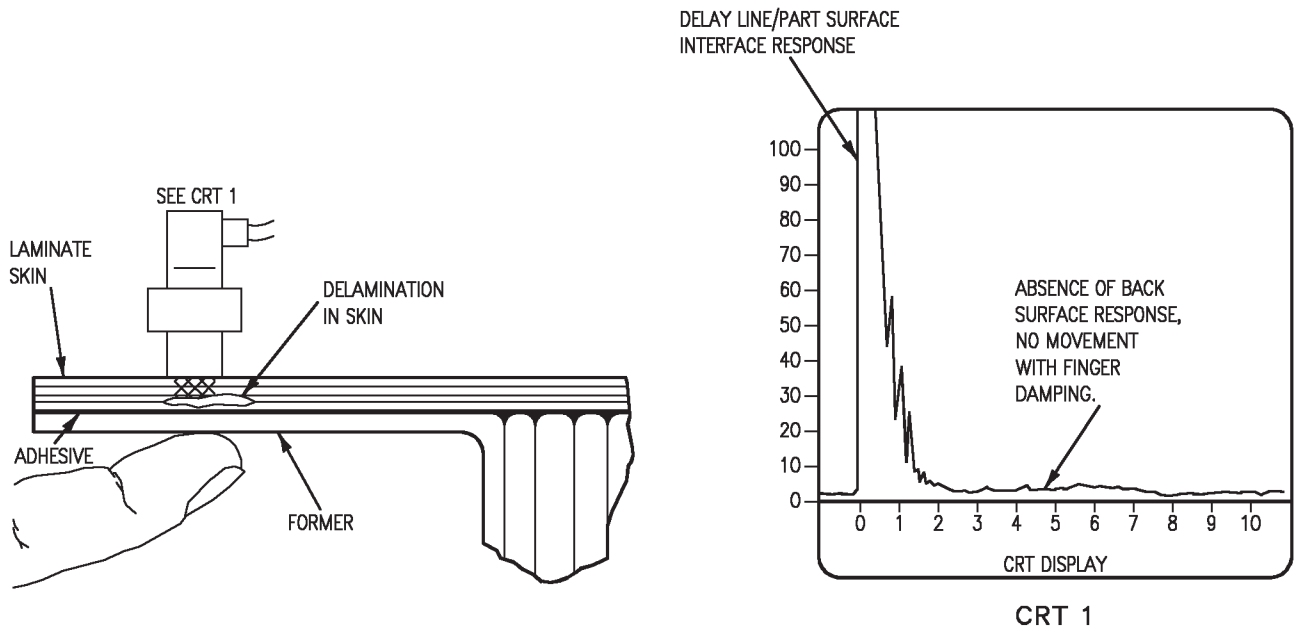


Figure 9. Typical Delamination and Unbond Responses (Sheet 1)

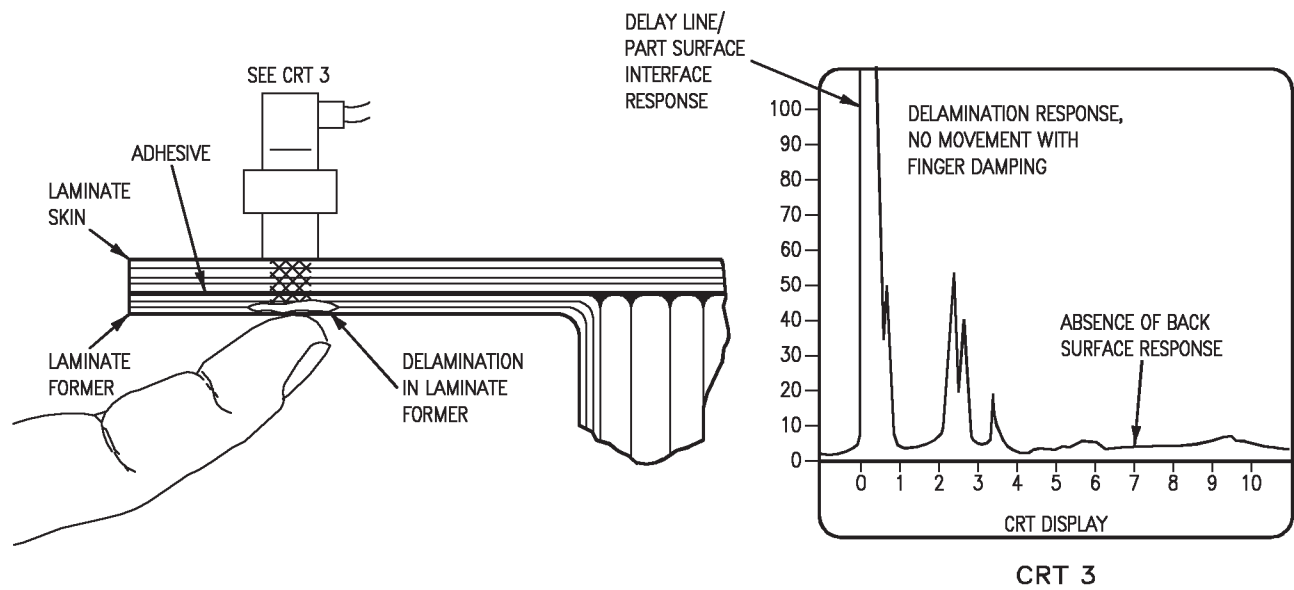


Figure 9. Typical Delamination and Unbond Responses (Sheet 2)



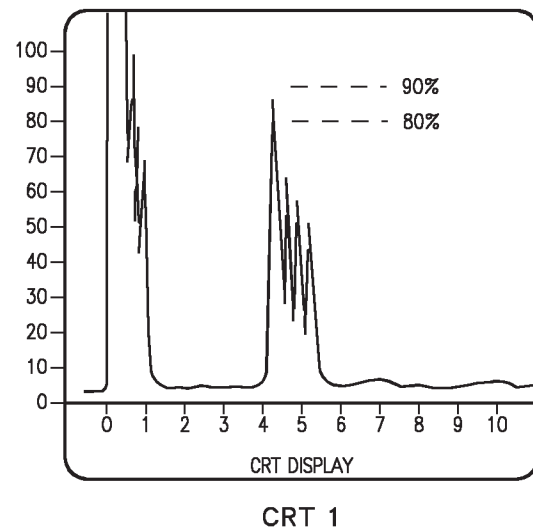
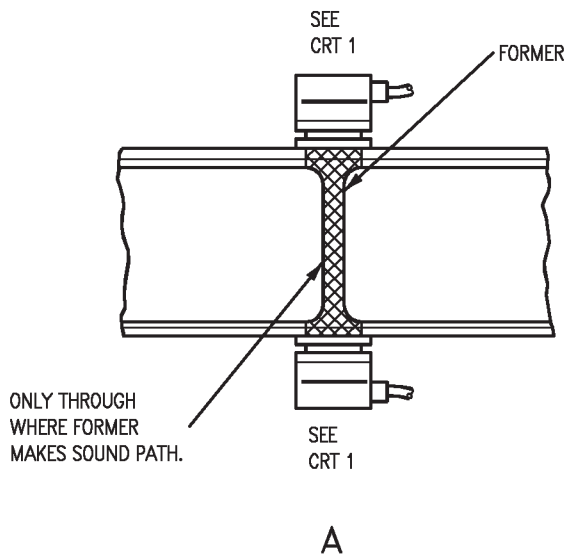
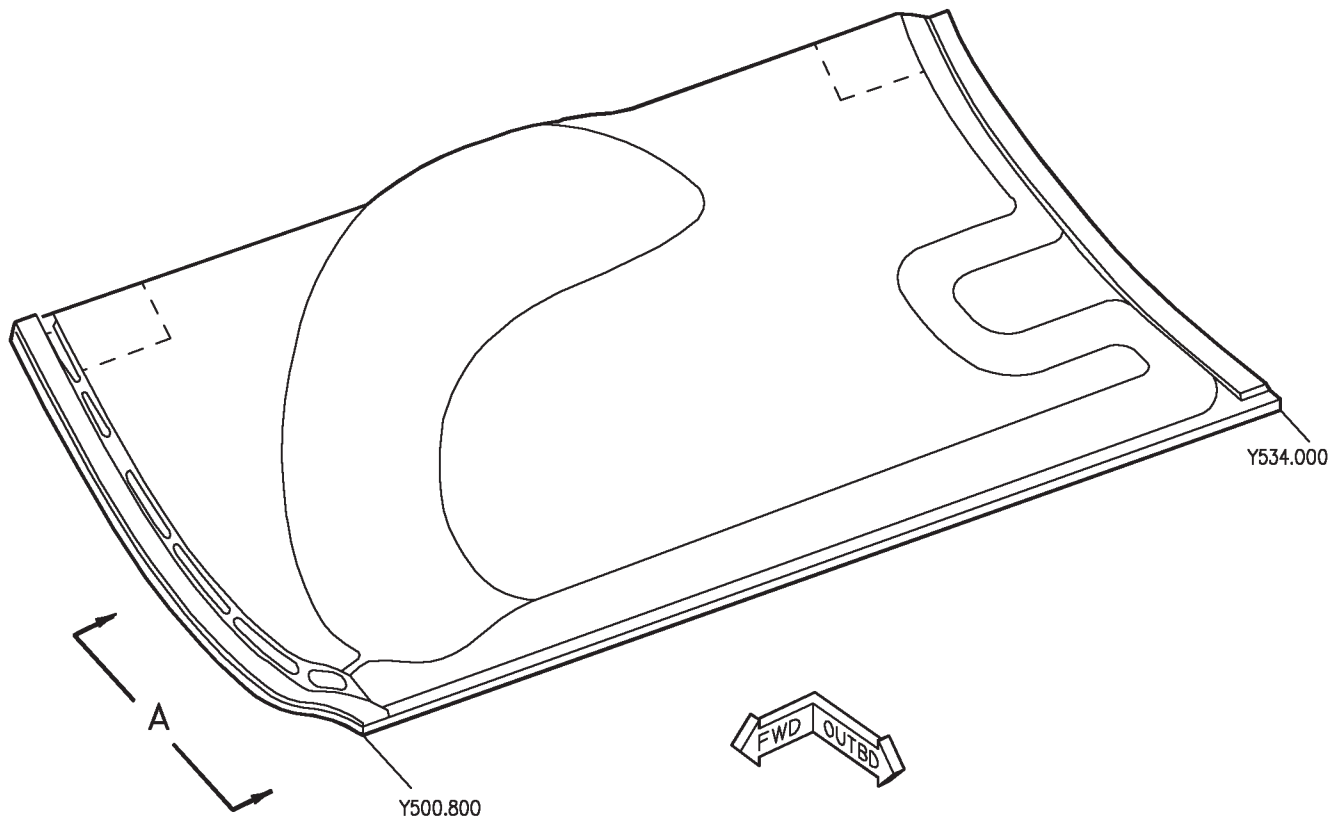
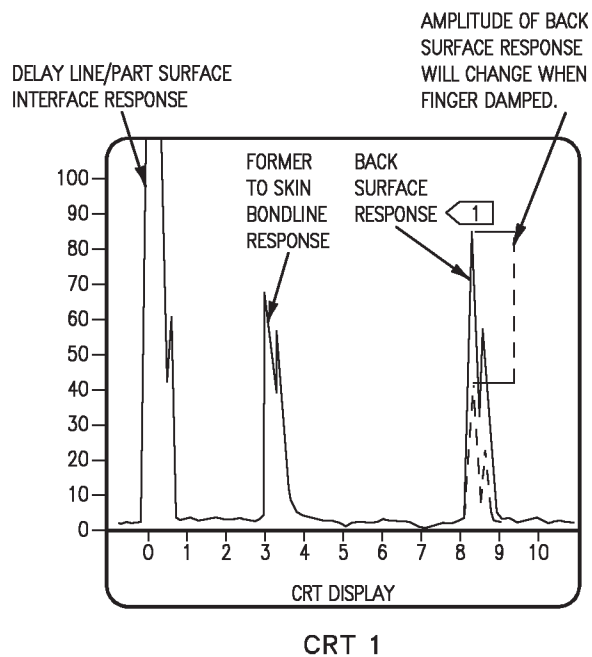
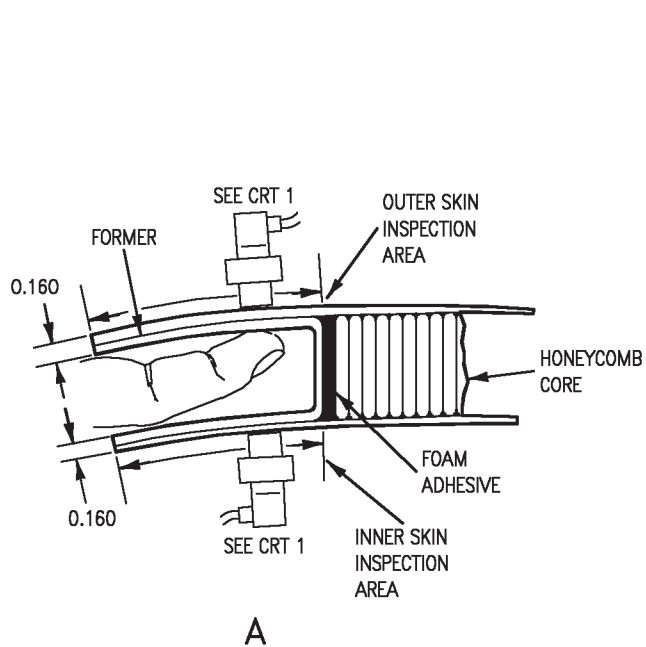
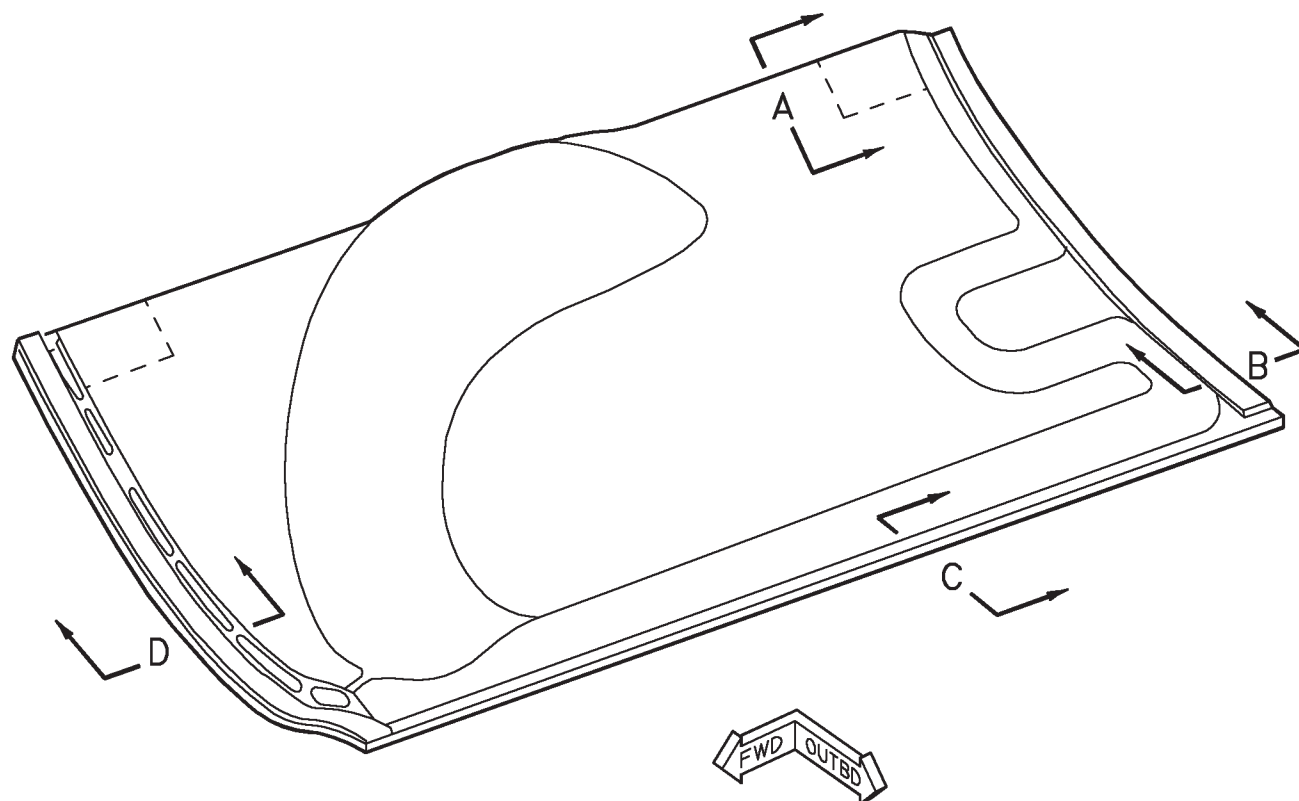


Figure 10. Inspection Responses for Thick Laminate



## LEGEND

- 1 AMPLITUDE AND LOCATION OF RESPONSE MAY DIFFER FROM DISPLAY SHOWN, BUT WILL NOT CHANGE WHEN BACK SURFACE IS DAMPED.

Figure 11. Additional Good Responses (Sheet 1)

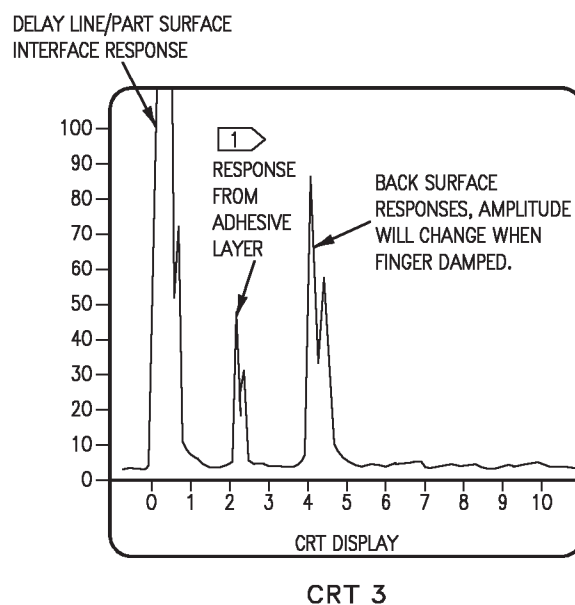
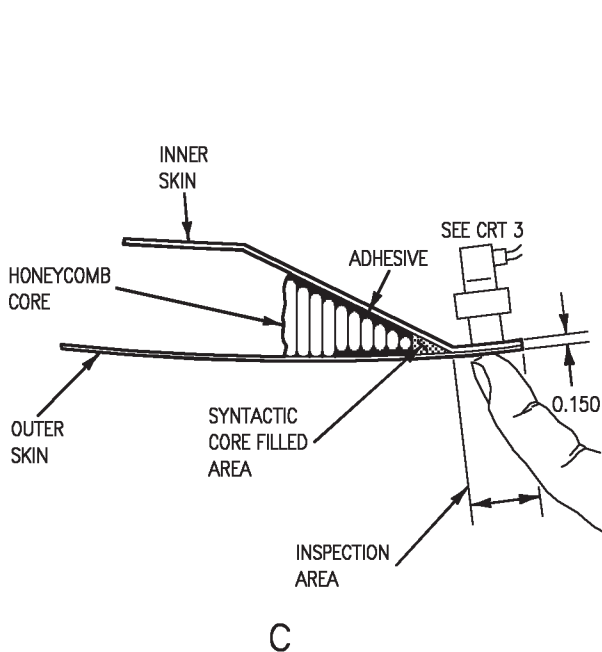
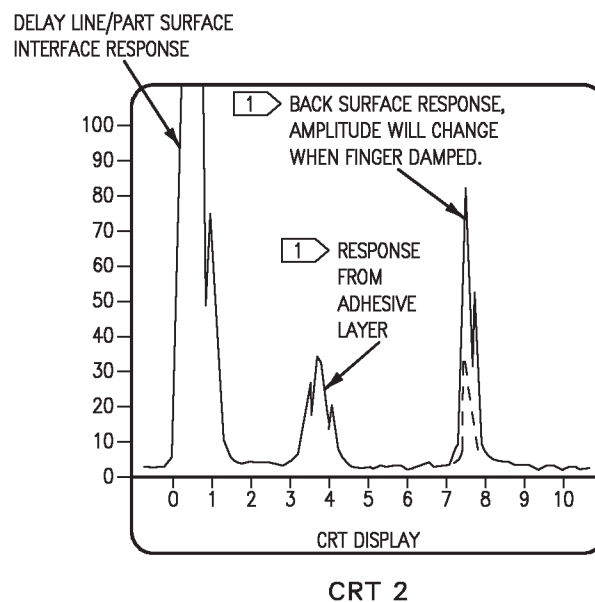
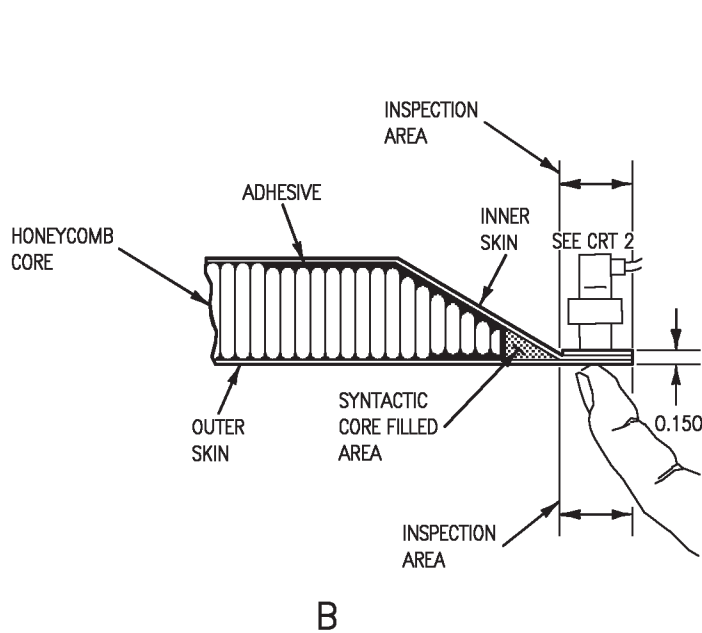
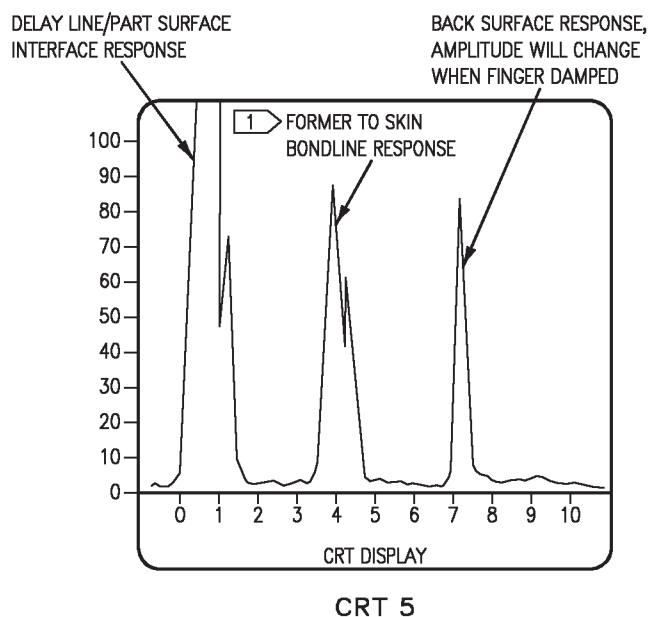
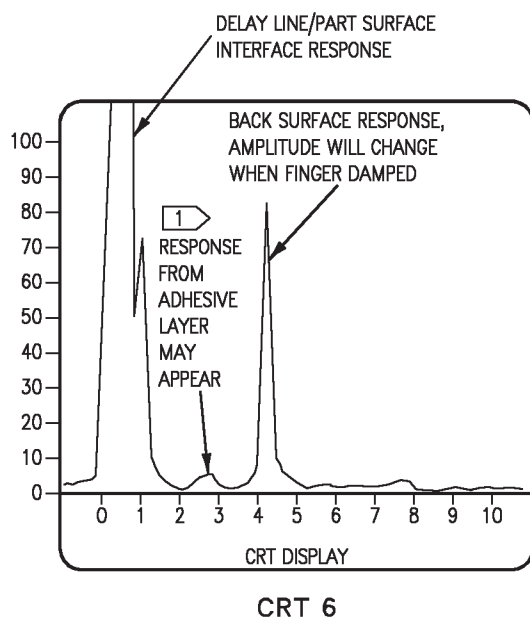
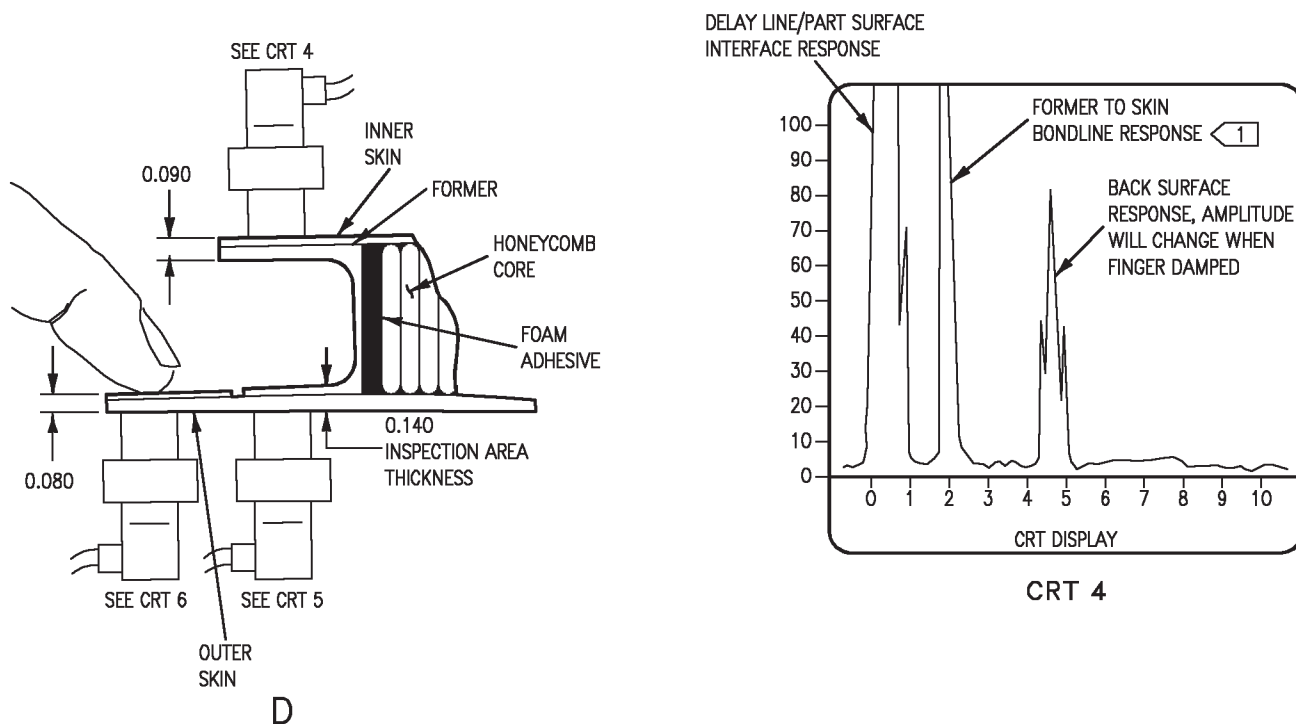


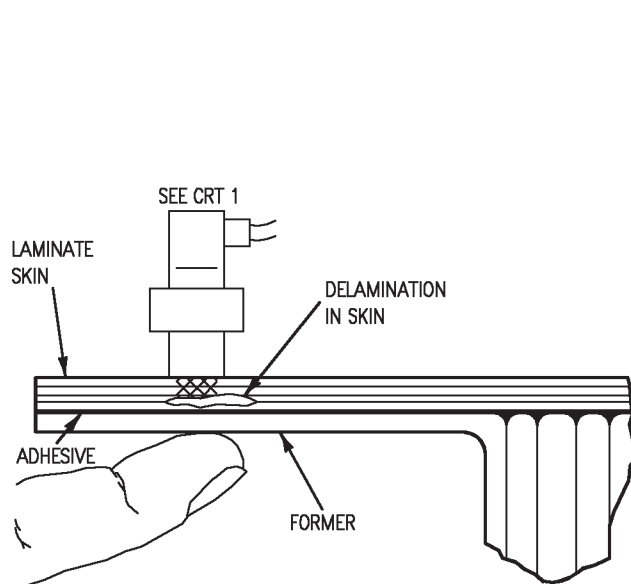
Figure 11. Additional Good Responses (Sheet 2)



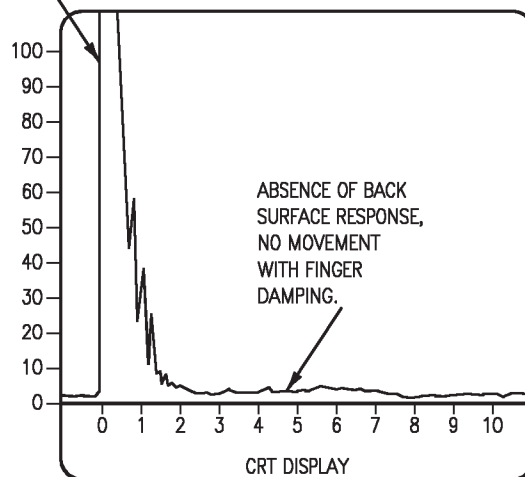
## LEGEND

- 1** AMPLITUDE AND LOCATION OF RESPONSE MAY DIFFER FROM DISPLAY SHOWN, BUT WILL NOT CHANGE WHEN BACK SURFACE IS DAMPED.

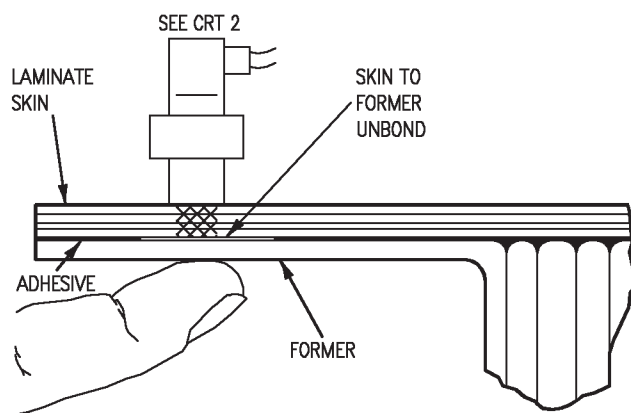
**Figure 11. Additional Good Responses (Sheet 3)**



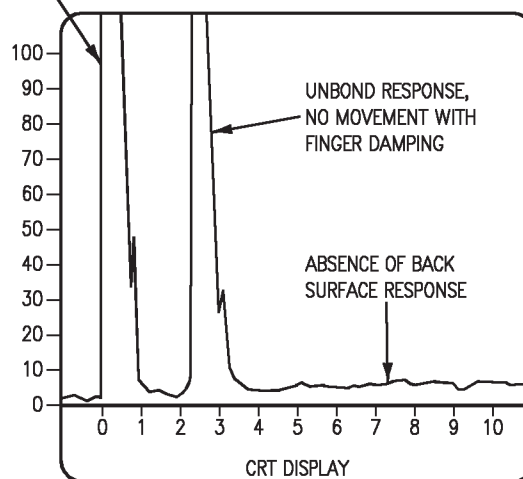
DELAY LINE/PART SURFACE  
INTERFACE RESPONSE



CRT 1



DELAY LINE/PART SURFACE  
INTERFACE RESPONSE



CRT 2

Figure 12. Additional Unbond Responses (Sheet 1)

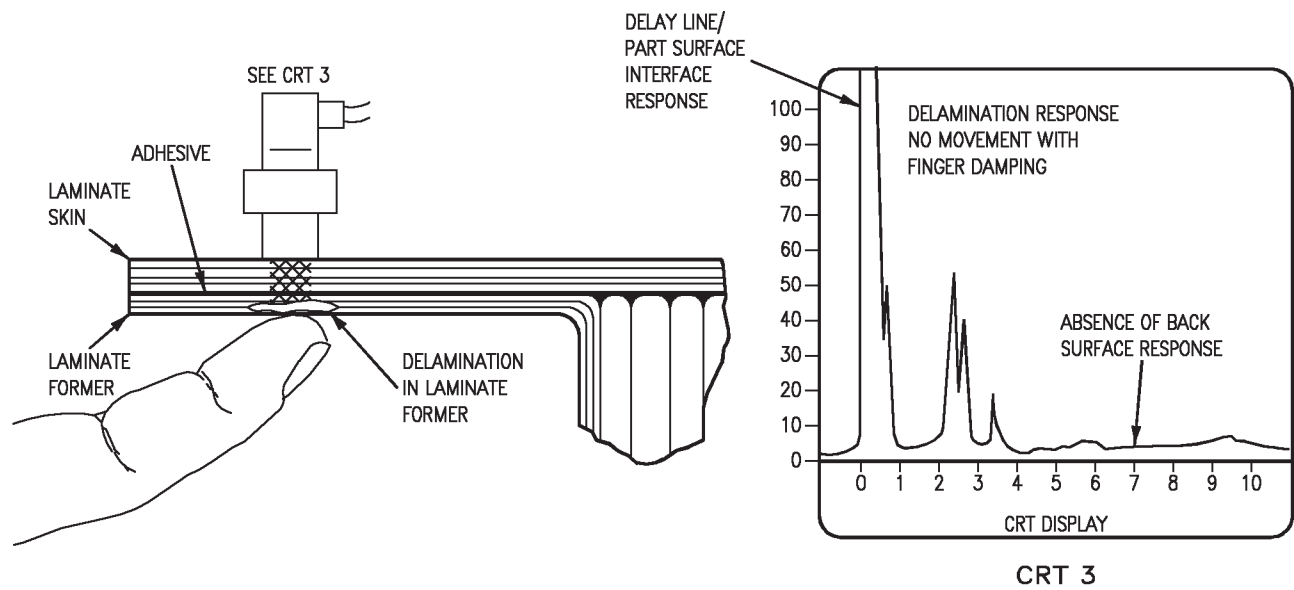


Figure 12. Additional Unbond Responses (Sheet 2)

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**INTERMEDIATE MAINTENANCE****NONDESTRUCTIVE INSPECTION****MAIN LANDING GEAR FORWARD DOOR****SKIN TO CORE UNBONDS AND EDGE DELAMINATIONS****PART NO. 74A426010**

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**Reference Material**

Naval Aviation Maintenance Program .....	OPNAVINST 4790.2
Plane Captain Manual .....	A1-F18AC-PCM-000
Nondestructive Inspection.....	A1-F18AC-SRM-300
General Information .....	WP003 00
Ultrasonic Through Transmission Contact Testing, Standardization, and Inspection Procedures for Composite Laminate Skin Bonded to Honeycomb Core.....	WP008 01
Pulse-Echo, Longitudinal Wave Contact, With Delay Line, for Composite Material .....	WP008 03
Pulse-Echo, Longitudinal Wave Contact, With Delay Line, for Composite Laminate Material Bonded to Honeycomb Core .....	WP008 04
Ultrasonic Through Transmission Contact Testing, Standardization and Inspection Procedures for Composite Laminate and Metallic Skins Bonded to Honeycomb Core .....	WP008 10
Pulse-Echo Longitudinal, Contact, With Delay Line, for Composite Laminate Materials.....	WP008 12
Pulse-Echo Longitudinal, Contact, With Delay Line, for Composite Laminate Material Bonded to Honeycomb Core .....	WP008 13

**Alphabetical Index**

<b>Subject</b>	<b>Page No.</b>
Main Landing Gear Forward Door.....	2
Defects .....	2
Post Inspection Cleaning and Corrosion Control.....	5
Primary Inspection Method .....	2
Ultrasonic Method Using C-398 Ultrasonic Flaw Detector .....	2
Ultrasonic Method Using MXU-715/E Ultrasonic Flaw Detector .....	4

**Record of Applicable Technical Directives**

None

**1. MAIN LANDING GEAR FORWARD DOOR.**

2. Main landing gear forward door, see figures 1 and 2, is a bonded honeycomb core assembly. Honeycomb core is 5056 aluminum alloy, F80, flexible core. Structure enclosing core is graphite epoxy and titanium. Skins are graphite epoxy composite laminate. Surface finish is epoxy primer and polyurethane coatings.

3. **DEFECTS.** Inspect for skin to core unbonds and edge delaminations. Examples of skin to core unbonds and delaminations are contained in (WP003 00).

4. **PRIMARY INSPECTION METHOD.** Primary inspection methods are ultrasonic through transmission and pulse-echo.

5. **Personnel Qualifications.** Personnel doing this nondestructive inspection shall be qualified and certified to do ultrasonic inspections per OPNAVINST 4790.2 SERIES, NDI Technicians, NEC 7225/MOS 6044.

6. **Preparation of Aircraft.** No special preparation required.

7. **Access.** No special access required.

**8. ULTRASONIC METHOD USING C-398 ULTRASONIC FLAW DETECTOR.****Support Equipment Required****NOTE**

Alternate item type designations or part numbers are listed in parentheses.

Part Number or Type Designation	Nomenclature
C-398 (303B)	Ultrasonic Flaw Detector
57A2271 or EQUIVALENT	Microdot to BNC Connecting Cable

**Support Equipment Required (Continued)**

Part Number or Type Designation	Nomenclature
57A2276 or EQUIVALENT	0°, 0.500 Dia., 2.25 MHz, Contact Search Unit, 2 Req'd.
GD0504	0°, 0.25 Dia., 5 MHz, Delay Line Contact Search Unit
74D110175-1001	Graphite Epoxy Reference Standard Set Containing the Following:
74D111295-1009	Graphite Epoxy Flat Bottom Hole Reference Standard for Laminates up to 0.450 Inch
74D111295-1005	Honeycomb Reference Standard With Graphite Epoxy Skins for Sandwich Assemblies Less Than 1 Inch

**Materials Required****NOTE**

Alternate item specifications or part numbers are shown indented.

Specification or Part Number	Nomenclature
ULTRAGEL II or EQUIVALENT	Couplant
MIL-P-83593-2, TYPE 1, CLASS A or B, BLACK or RED	Aircraft Marking Pencil
P-D-680, TYPE 2 D 1153	Dry Cleaning Solvent Methyl Isobutyl Ketone
CCC-C-46, TYPE I, CLASS 4	Cleaning Cloth



**WARNING**

Dry cleaning solvent and methyl isobutyl ketone are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

9. **Preparation of Part.** Clean inspection area(s) with water, if required, solvent moistened cloth to make sure inspection area(s) is free of contamination or foreign material.

**WARNING**

Make sure safety precautions have been met for electrical, static, grounding when using ultrasonic equipment near aircraft fuel cells, oxygen systems, electronic systems, and stores (A1-F18AC-PCM-000).

10. **Equipment Settings/Standardization/Setup for Skin to Core and thick Laminate Areas.** Do standardization per (WP008 01), and as specified below:

a. Use two 57A2276 search unit.

b. Use P-1 calibration point on the 74D111295-1005 graphite epoxy skinned honeycomb core sandwich assembly reference standard.

11. **Inspection Procedure for Skin to Core and Thick Laminate Areas.** See figures 3 through 6. After standardization, inspect skin to core area of door per (WP008 01), except as specified below:

a. Use two 57A2276 search units.

b. Apply couplant to both surfaces of inspection area(s).

c. Make sure initial pulse width does not interfere with location of received response. If required, switch position of search units on microdot cables or use different search unit on receiver cable.

d. Inspect thick laminate areas of formers and missile fairing areas as shown in figure 10.

e. Use ultrasonic pulse-echo per (WP008 04) to determine if suspect area(s) is result of skin delaminations. Do pulse-echo inspection on both surfaces to help identify location of flaws causing through transmission unbond response.

**WARNING**

12. **Equipment Settings/Standardization/Setup for Thin Laminate and Skin to Structure Areas.** See figures 7 and 8. Do standardization for thin laminates and skin to structure areas per (WP008 03). Make sure trailing edge of initial pulse is located at less than 1 large division when 0.100 inch FBH response is 80 to 90 percent CRT height.

13. **Inspection Procedure for Thin Laminate and Skin to Structure Areas.** See figure 9. Inspect thin laminate and skin to structure areas per (WP008 03) and following:

a. Apply couplant to solid laminate inspection area where laminate thickness is known.

b. Make sure leading edge of back surface response is located at correct location on horizontal baseline when peak amplitude is 80 to 90 CRT height.

c. Scan area to be inspected, finger damping back surface response often as required to make sure correct response is being received. Finger damp by placing couplant on end of finger and touching opposite surface. As finger touches and is removed from part surface, reflected response on CRT will move up and down as it is damped, indicating good bond.

d. For inspection responses in addition to those described in (WP008 03), refer to figure 11 for good responses and figure 12 for unbond responses.

e. Use pulse-echo mapping techniques per (WP008 03) to determine extent of flaw indication.

f. Do paragraph 20.

#### 14. ULTRASONIC METHOD USING MXU-715/E ULTRASONIC FLAW DETECTOR.

##### Support Equipment Required

Part Number or Type Designation	Nomenclature
1642AS100-1	Ultrasonic Flaw Detector, MXU-715/E, Magnaflux
57A2271 or EQUIVALENT 57A2276 or EQUIVALENT	Microdot to BNC Connecting Cable 0°, 0.500 Dia., 2.25 MHz, Contact Search Unit, 2 Req'd.
GD0504	0°, 0.25 Dia., 5 MHz, Delay Line Contact Search Unit
74D110175-1001	Graphite Epoxy Refer- ence Standard Set Containing the Following:
74D111295-1009	Graphite Epoxy Flat Bottom Hole Reference Standard for Laminates up to 0.450 Inch
74D111295-1005	Honeycomb Reference Standard With Graphite Epoxy Skins for Sandwich Assemblies Less Than 1 Inch

##### Materials Required

###### NOTE

Alternate item specifications or part numbers are shown indented.

Specification or Part Number	Nomenclature
ULTRAGEL II or EQUIVALENT	Couplant
MIL-P-83593-2, TYPE 1, CLASS A or B, BLACK or RED	Aircraft Marking Pencil

##### Materials Required (Continued)

###### NOTE

Alternate item specifications or part numbers are shown indented.

Specification or Part Number	Nomenclature
P-D-680, TYPE 2 D 1153	Dry Cleaning Solvent Methyl Isobutyl Ketone
CCC-C-46, TYPE I, CLASS 4	Cleaning Cloth

###### WARNING

Dry cleaning solvent and methyl isobutyl ketone are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

15. **Preparation of Part.** Clean inspection area(s) with water, if required, solvent moistened cloth to make sure inspection area(s) is free of contamination or foreign material.

###### WARNING

Make sure safety precautions have been met for electrical, static, grounding when using ultrasonic equipment near aircraft fuel cells, oxygen systems, electronic systems, and stores (A1-F18AC-PCM-000).

16. **Equipment Settings/Standardization/Setup for Skin to Core and thick Laminate Areas.** Do standardization per (WP008 10), and as specified below:

a. Use two 57A2276 search unit.

b. Use P-1 calibration point on the 74D111295-1005 graphite epoxy skinned honeycomb core sandwich assembly reference standard.

## 17. Inspection Procedure for Skin to Core and

**Thick Laminate Areas.** See figures 3 through 6. After standardization, inspect skin to core area of door per (WP008 10), except as specified below:

- a. Use two 57A2276 search units.
- b. Apply couplant to both surfaces of inspection area(s).
- c. Make sure initial pulse width does not interfere with location of received response. If required, switch position of search units on microdot cables or use different search unit on receiver cable.
- d. Inspect thick laminate areas of formers and missile fairing areas as shown in figure 10.
- e. Use ultrasonic pulse-echo per (WP008 13) to determine if suspect area(s) is result of skin delaminations. Do pulse-echo inspection on both surfaces to help identify location of flaws causing through transmission unbond response.

### WARNING

## 18. Equipment Settings/Standardization/Setup for Thin Laminate and Skin to Structure Areas.

See figures 7 and 8. Do standardization for thin laminates and skin to structure areas per (WP008 12). Make sure trailing edge of initial pulse is located at less than 1 large division when 0.100 inch FBH response is 80 to 90 percent CRT height.

**19. Inspection Procedure for Thin Laminate and Skin to Structure Areas.** See figure 9. Inspect thin laminate and skin to structure areas per (WP008 12) and following:

a. Apply couplant to solid laminate inspection area where laminate thickness is known.

b. Make sure leading edge of back surface response is located at correct location on horizontal baseline when peak amplitude is 80 to 90 CRT height.

c. Scan area to be inspected, finger damping back surface response often as required to make sure correct response is being received. Finger damp by placing couplant on end of finger and touching opposite surface. As finger touches and is removed from part surface, reflected response on CRT will move up and down as it is damped, indicating good bond.

d. For inspection responses in addition to those described in (WP008 12), refer to figure 11 for good responses and figure 12 for unbond responses.

e. Use pulse-echo mapping techniques per (WP008 12) to determine extent of flaw indication.

### WARNING

Dry cleaning solvent and methyl isobutyl ketone are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

**20. POST INSPECTION CLEANING AND CORROSION CONTROL.** Clean couplant and markings from flap with water or, if required, solvent moistened cloth.





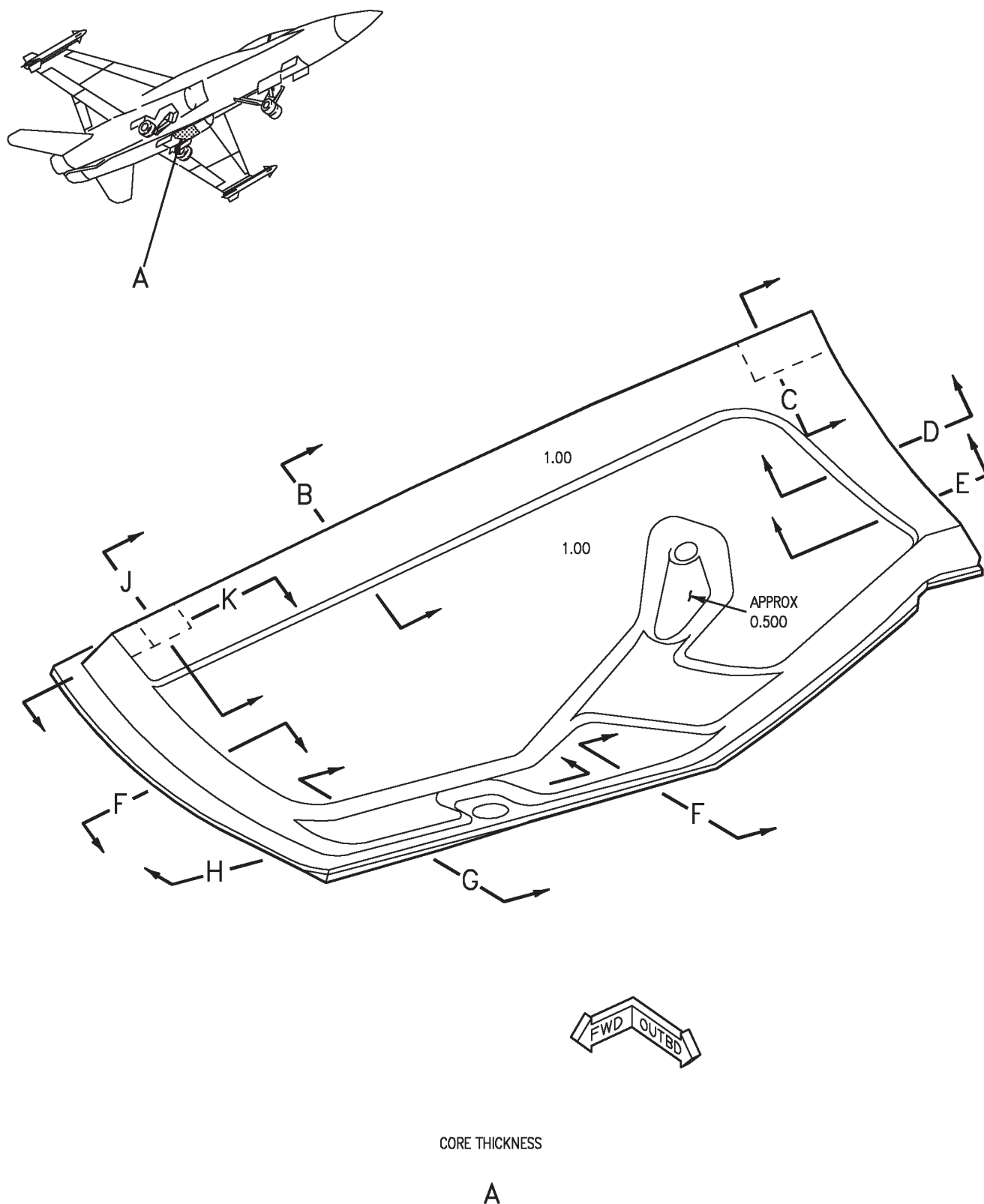


Figure 1. Structure and Core Thickness (Sheet 1)

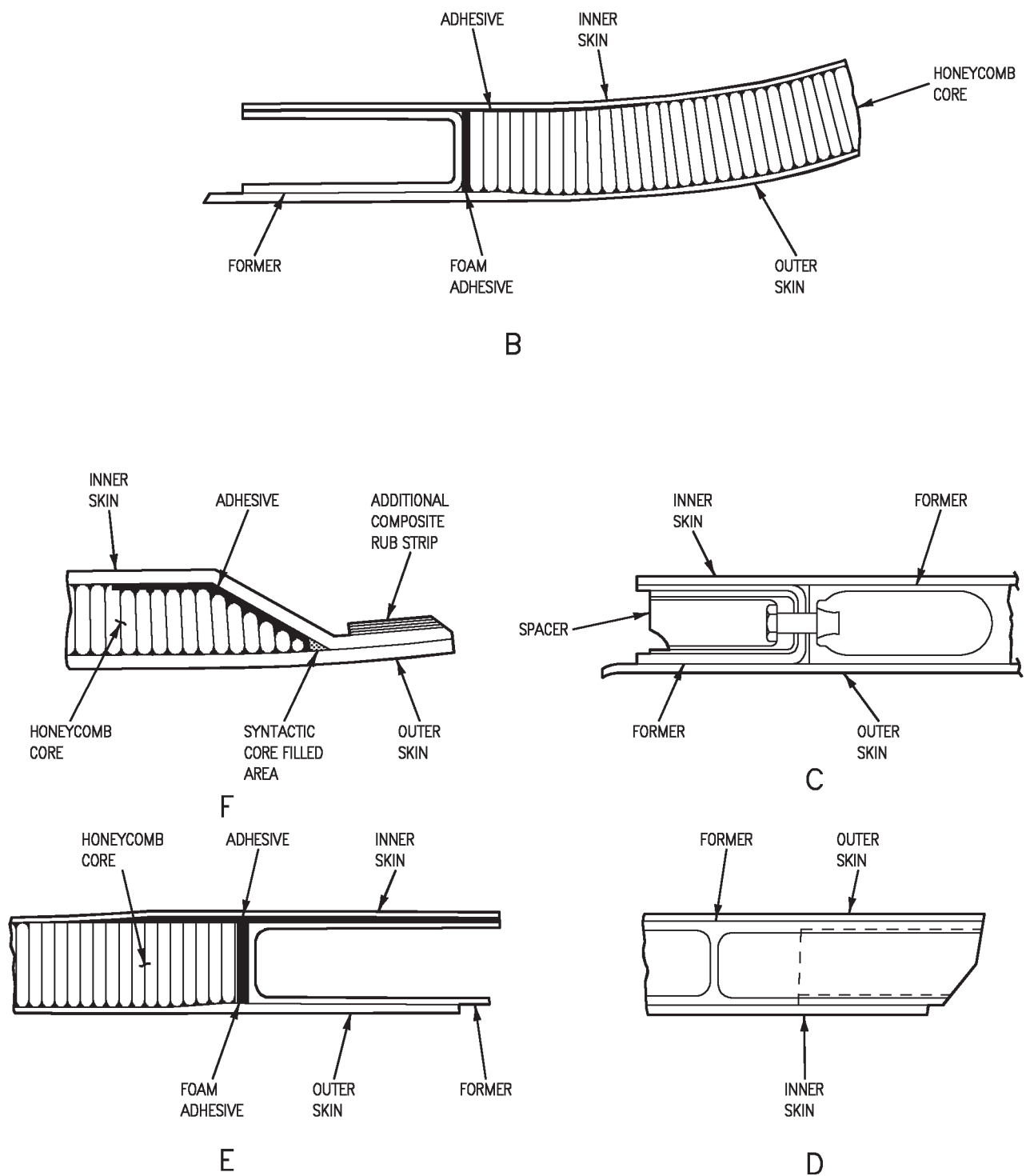


Figure 1. Structure and Core Thickness (Sheet 2)

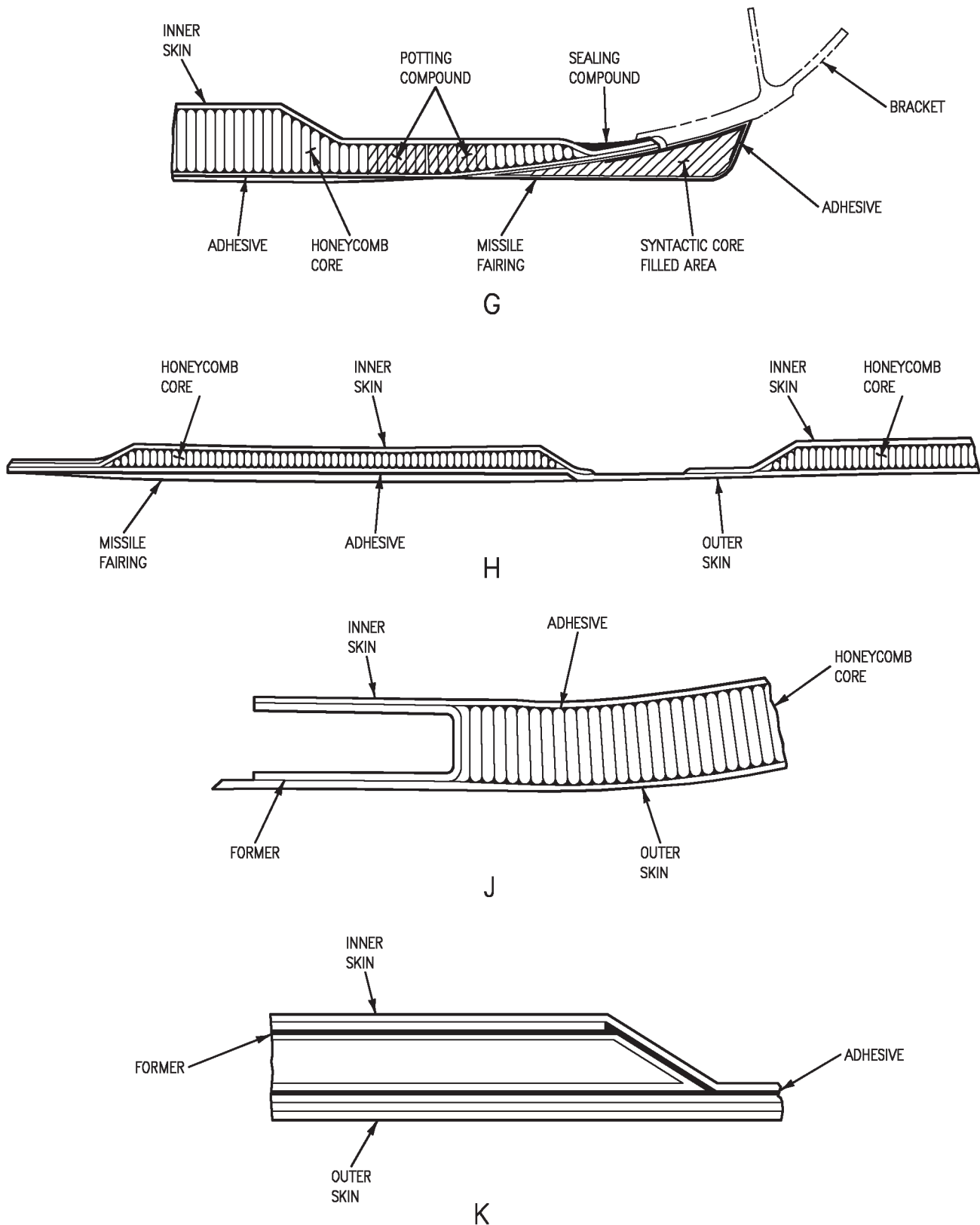


Figure 1. Structure and Core Thickness (Sheet 3)



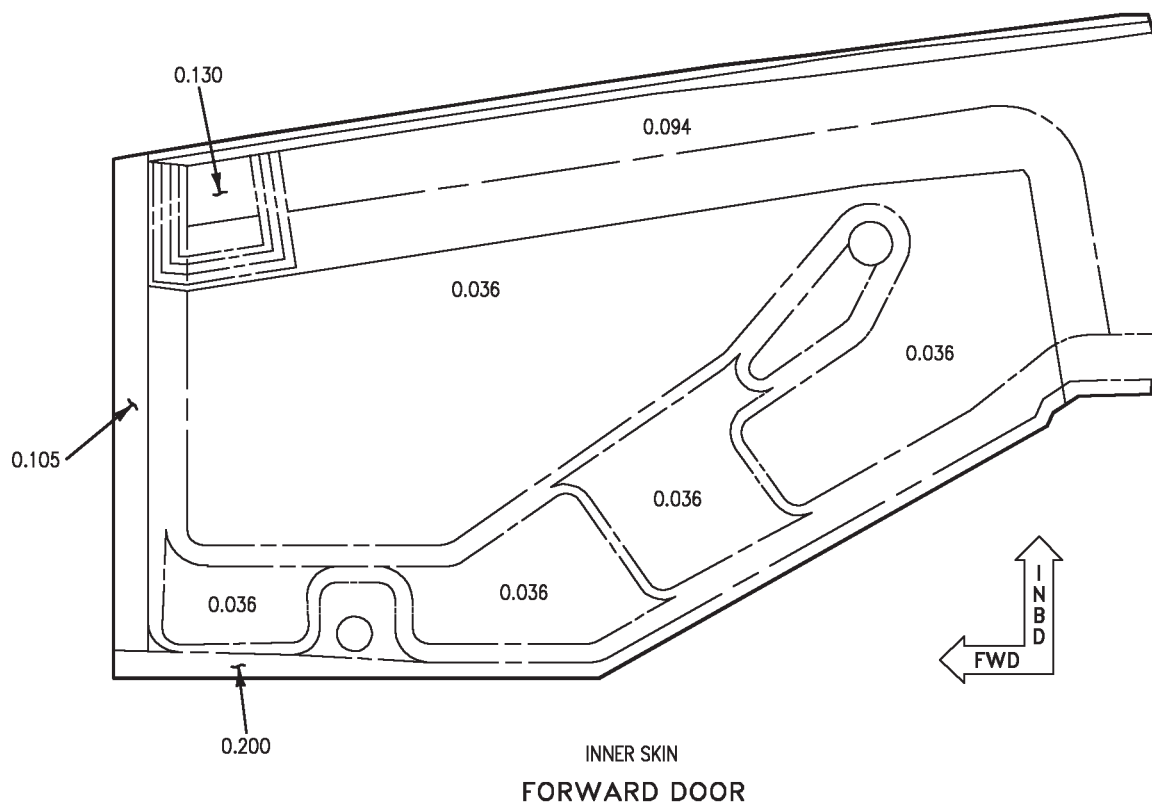
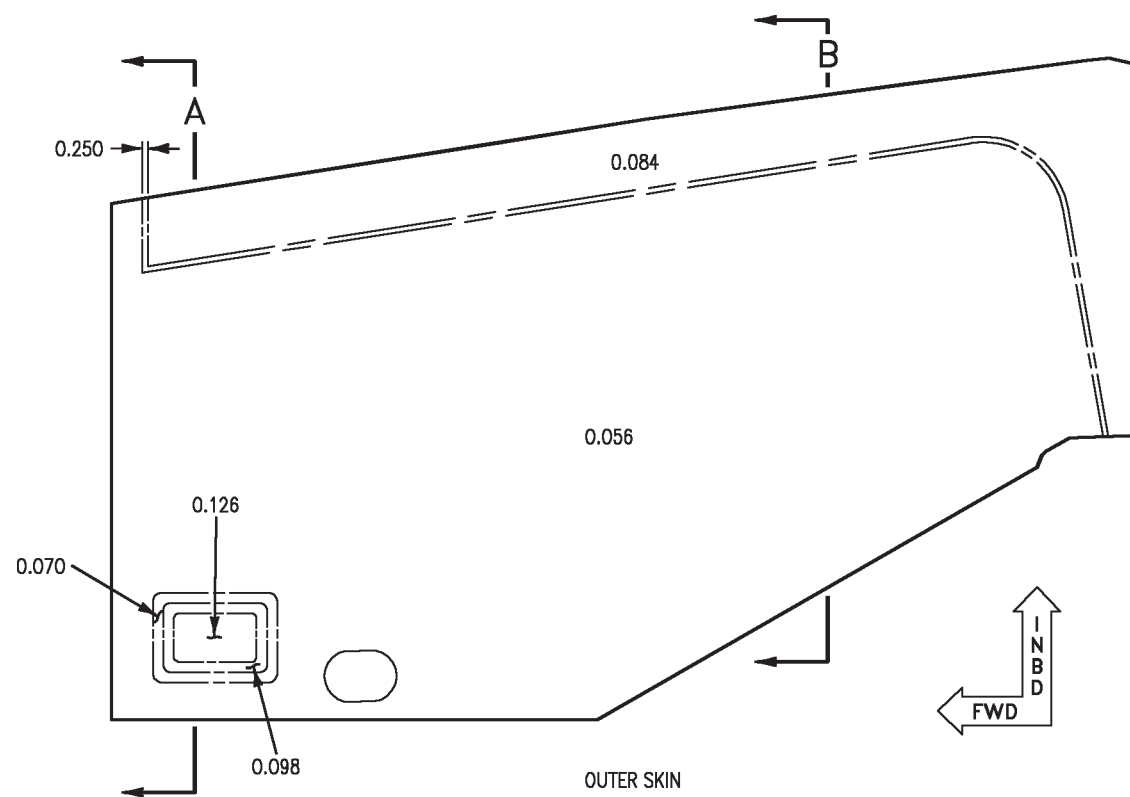


Figure 2. Typical Skin Thicknesses (Sheet 1)

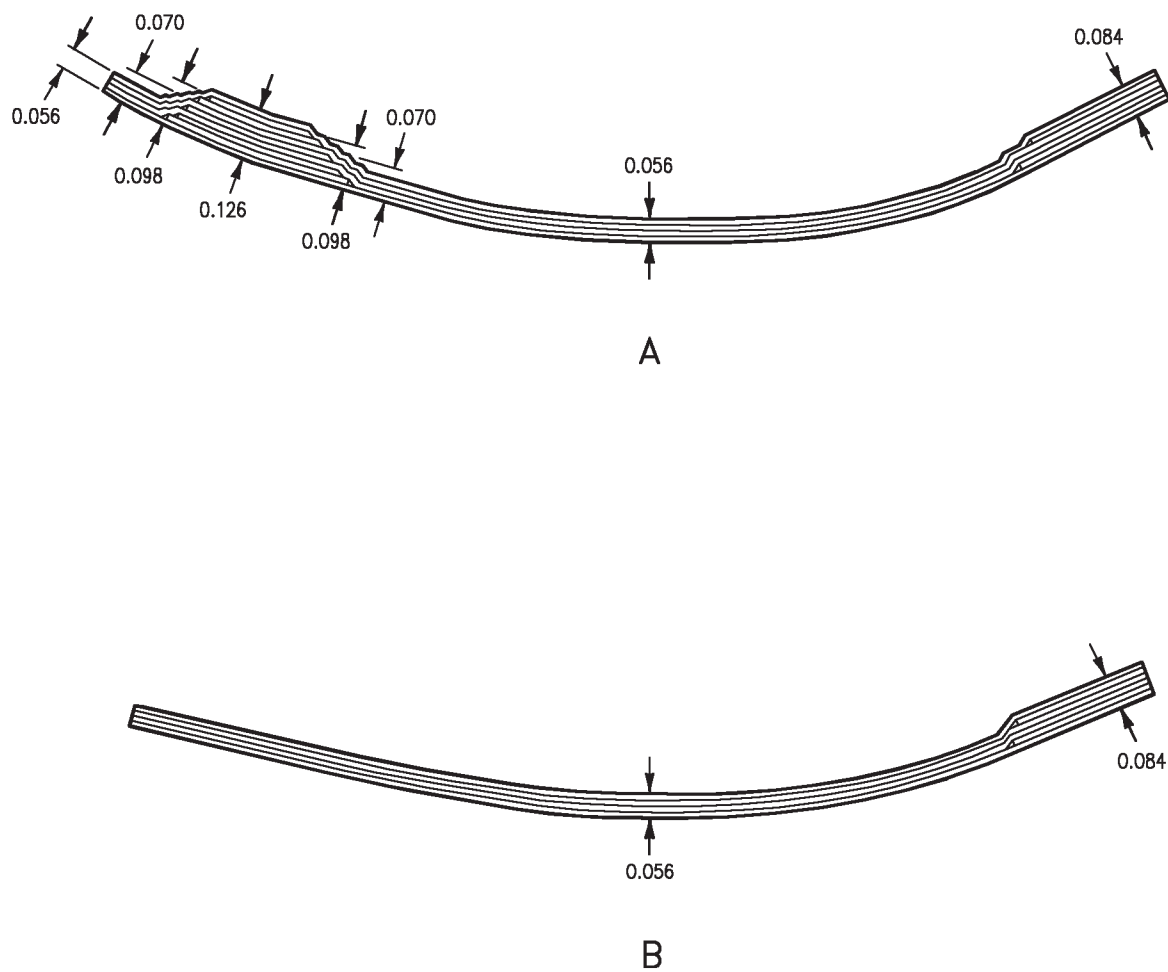
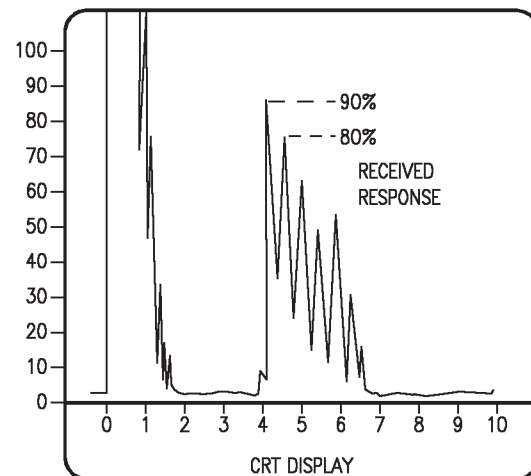
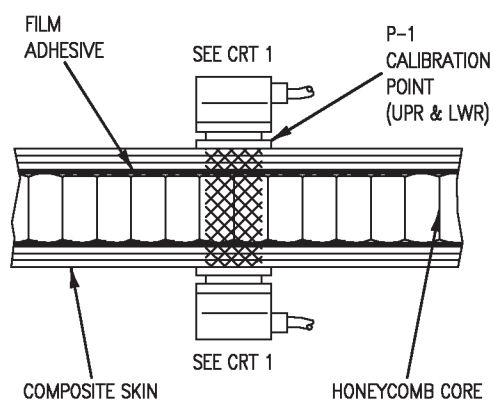


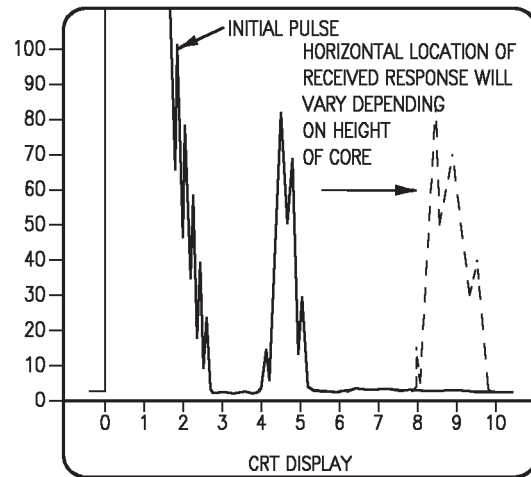
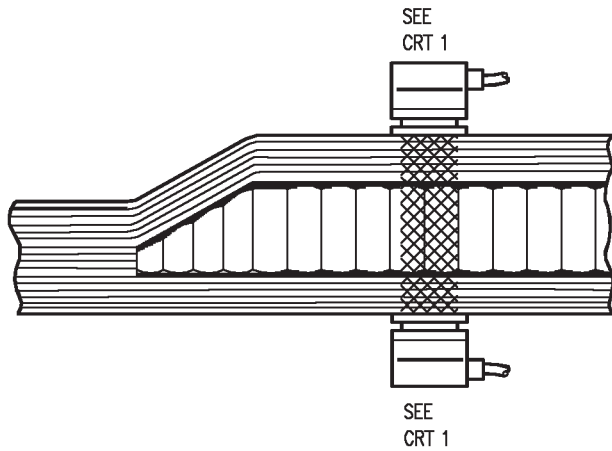
Figure 2. Typical Skin Thicknesses (Sheet 2)



CRT 1

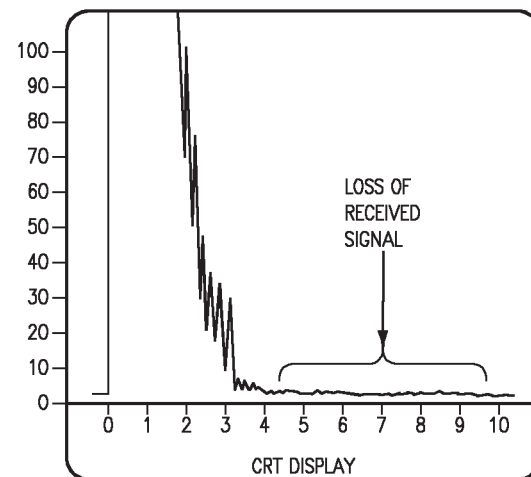
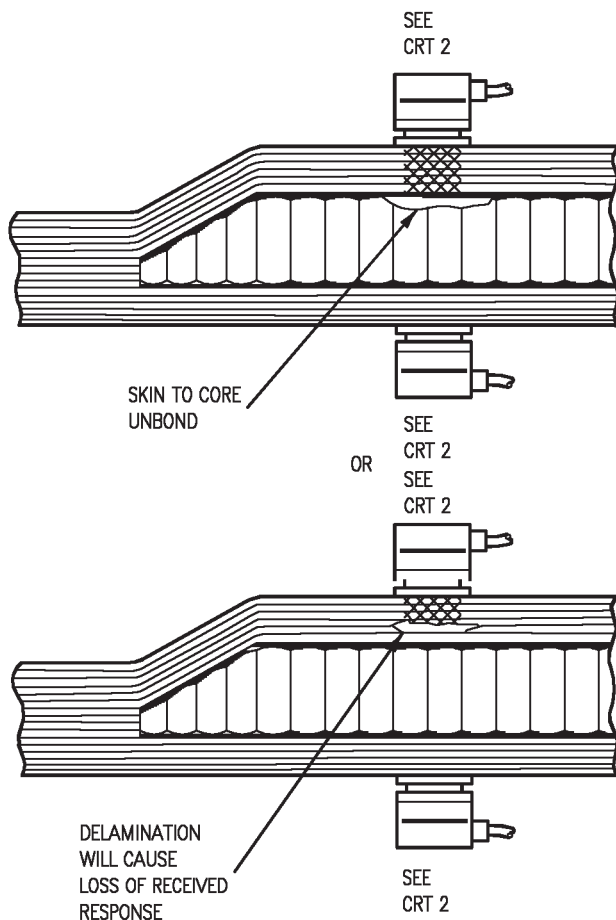
LEADING EDGE OF RECEIVED RESPONSE  
LOCATED AT 4 ON THE HORIZONTAL BASELINE.

Figure 3. Honeycomb Core Inspection Responses



**CRT 1**

(TYPICAL) SKIN TO CORE  
GOOD BOND RESPONSE



**CRT 2**

(TYPICAL) SKIN TO CORE  
UNBOND RESPONSE

**Figure 4. Honeycomb Core Inspection Responses**

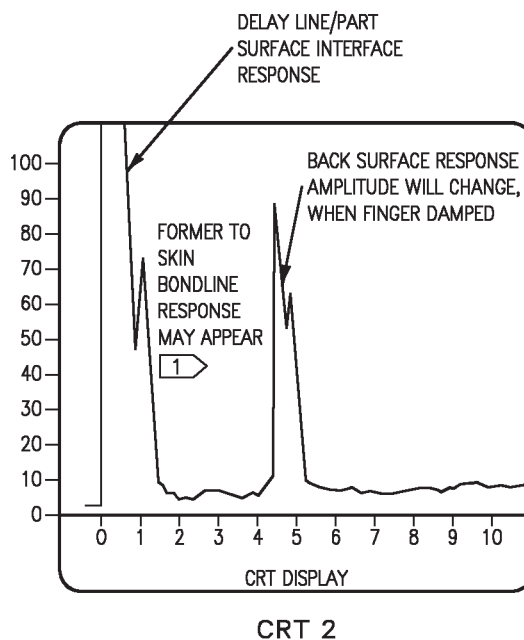
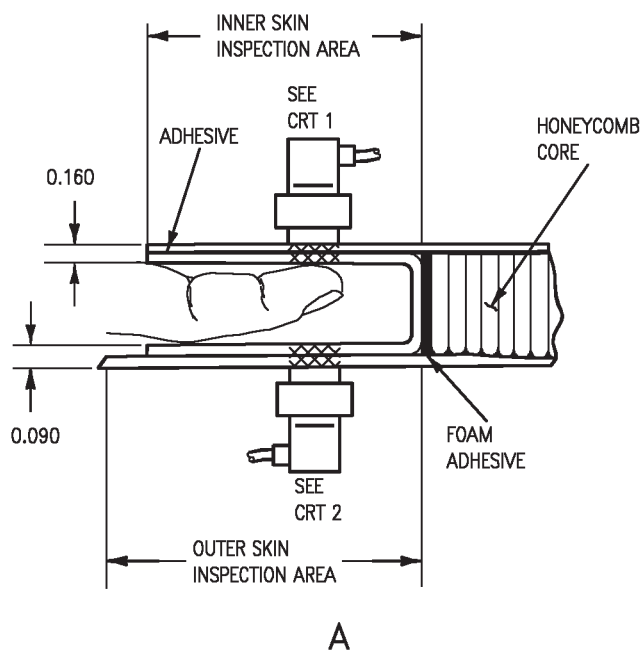
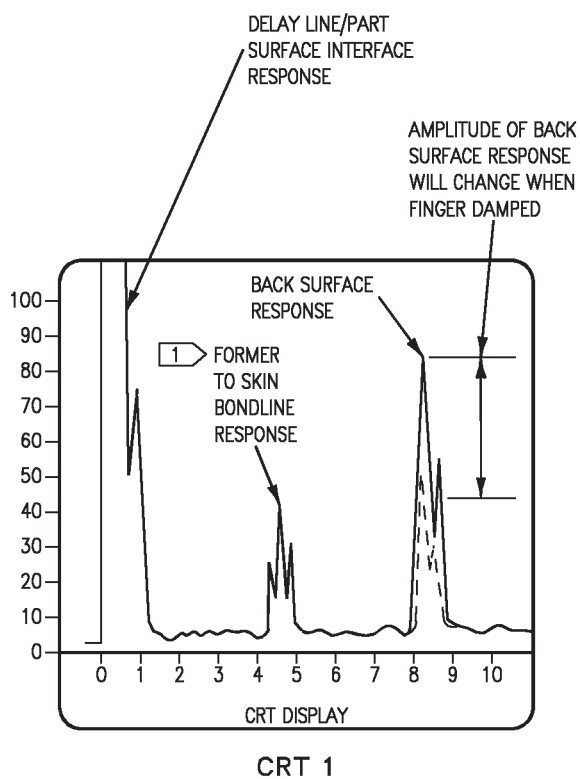
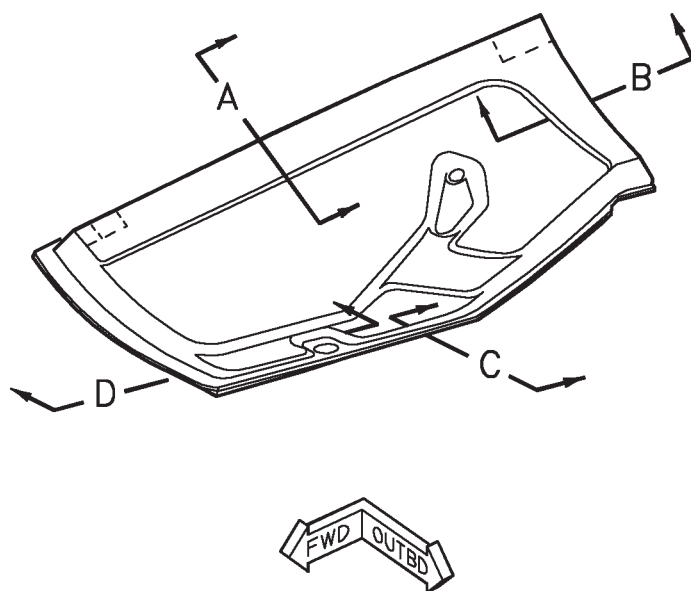


Figure 5. Inspection Area Thickness and Typical Good Responses (Sheet 1)

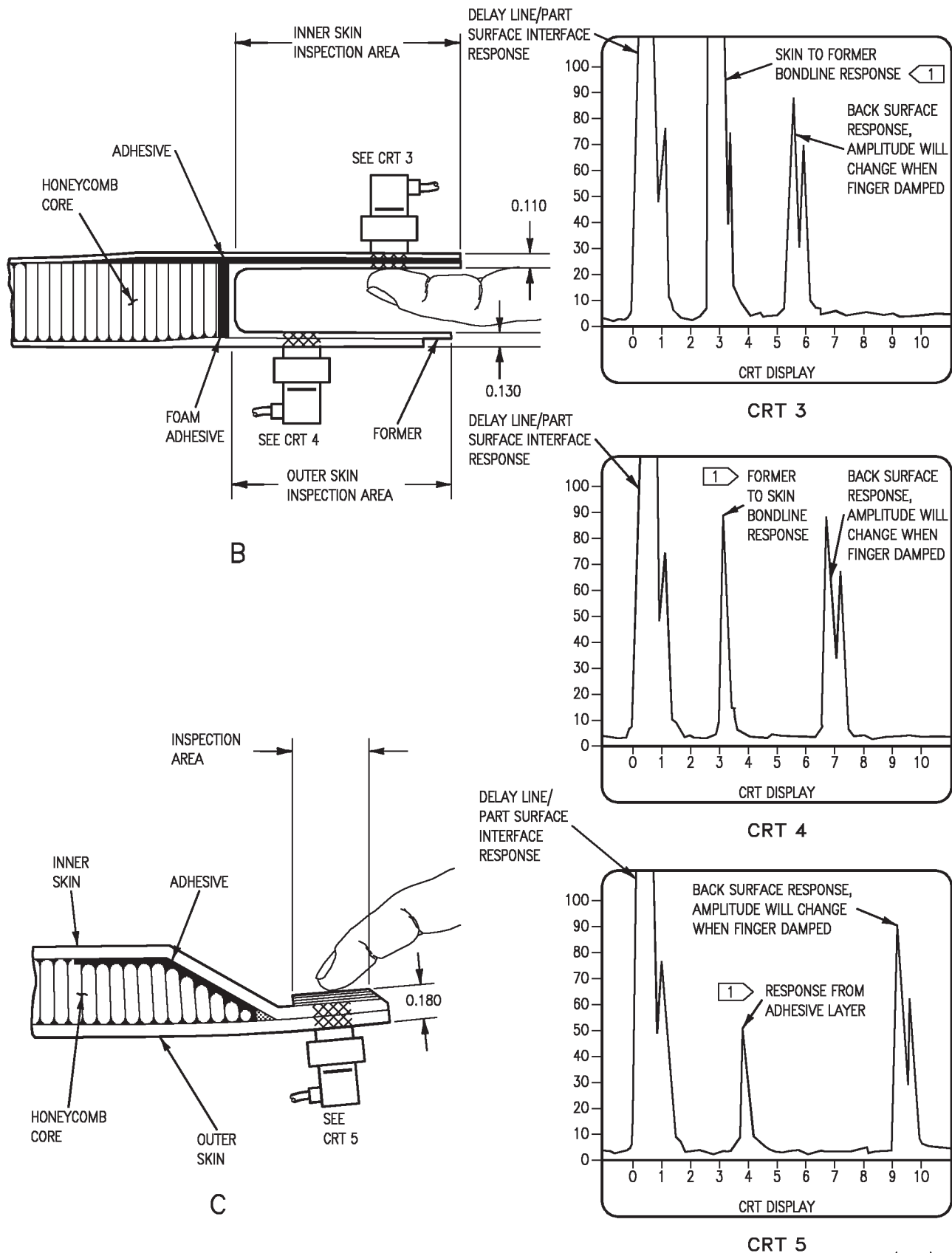
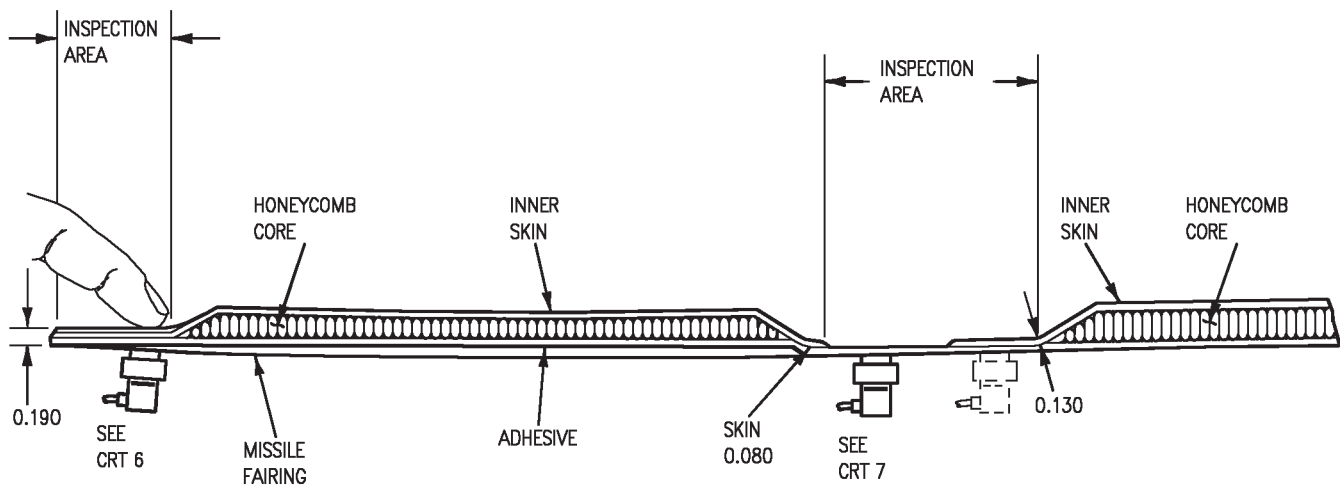
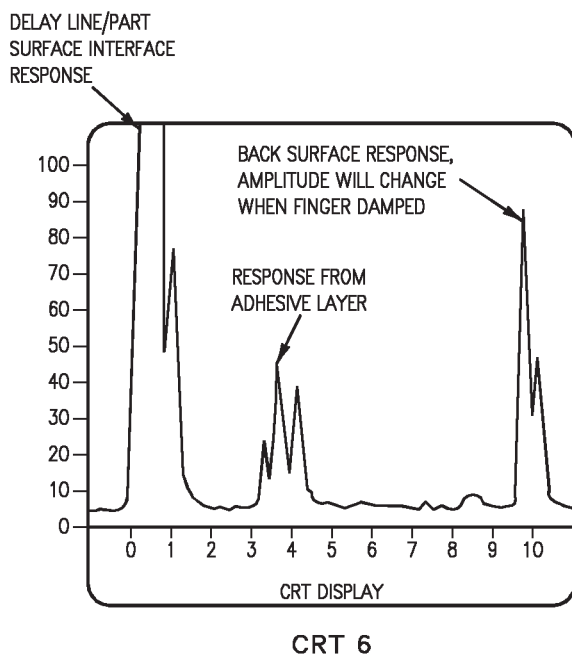


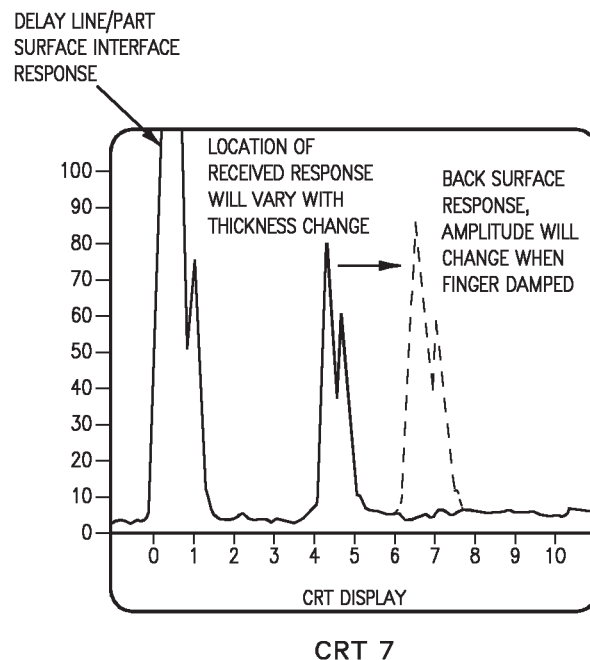
Figure 5. Inspection Area Thickness and Typical Good Responses (Sheet 2)



D



CRT 6

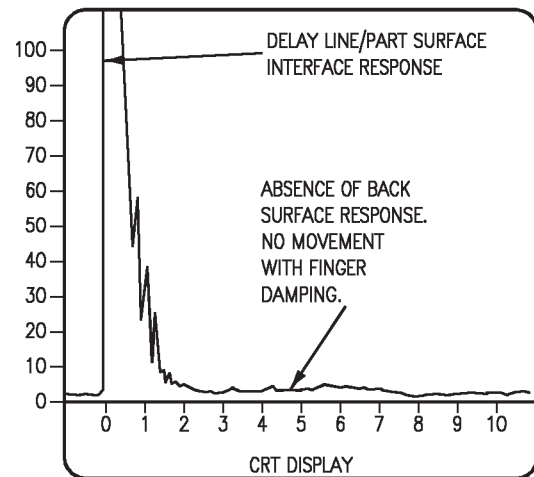
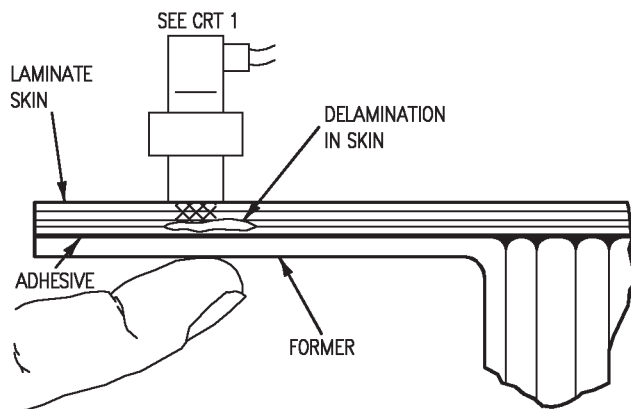


CRT 7

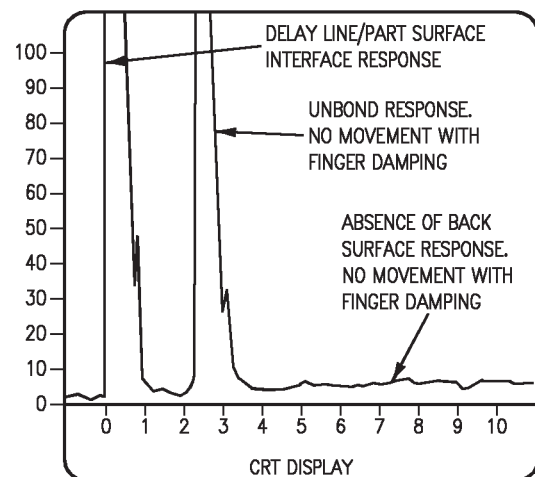
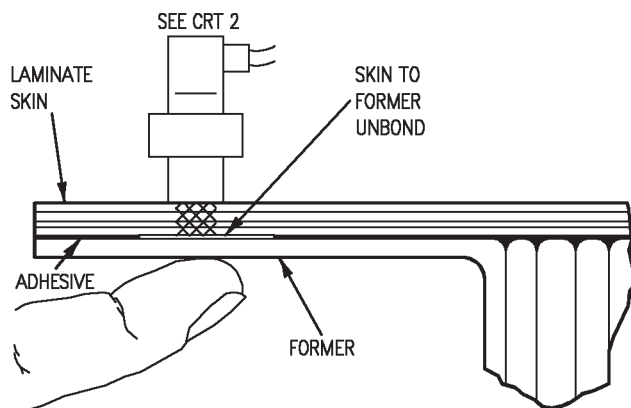
### LEGEND

- 1 AMPLITUDE AND LOCATION OF RESPONSE MAY DIFFER FROM DISPLAY SHOWN, BUT WILL NOT CHANGE WHEN BACK SURFACE IS DAMPED.

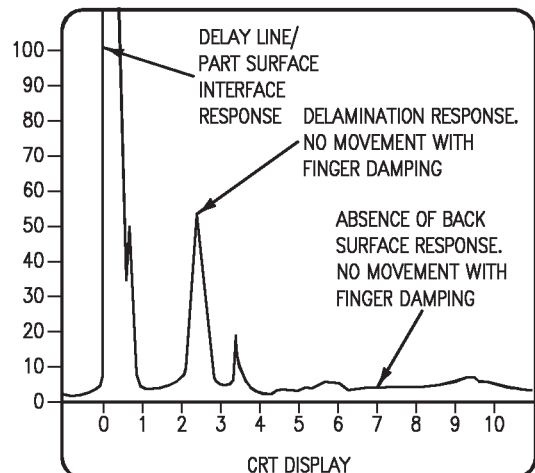
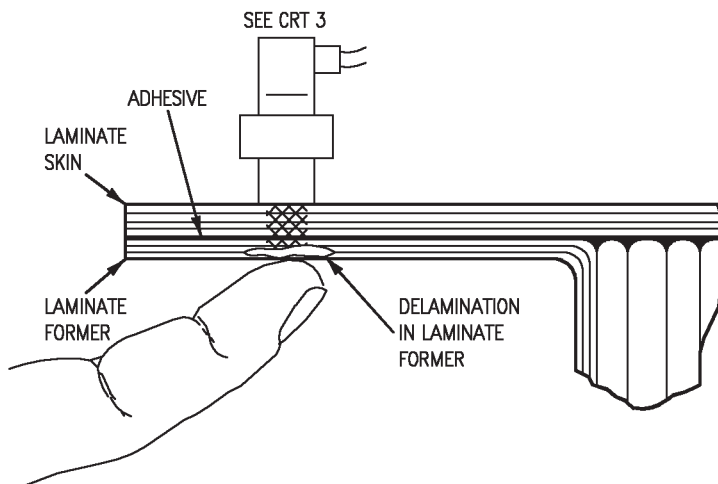
Figure 5. Inspection Area Thickness and Typical Good Responses (Sheet 3)



CRT 1



CRT 2

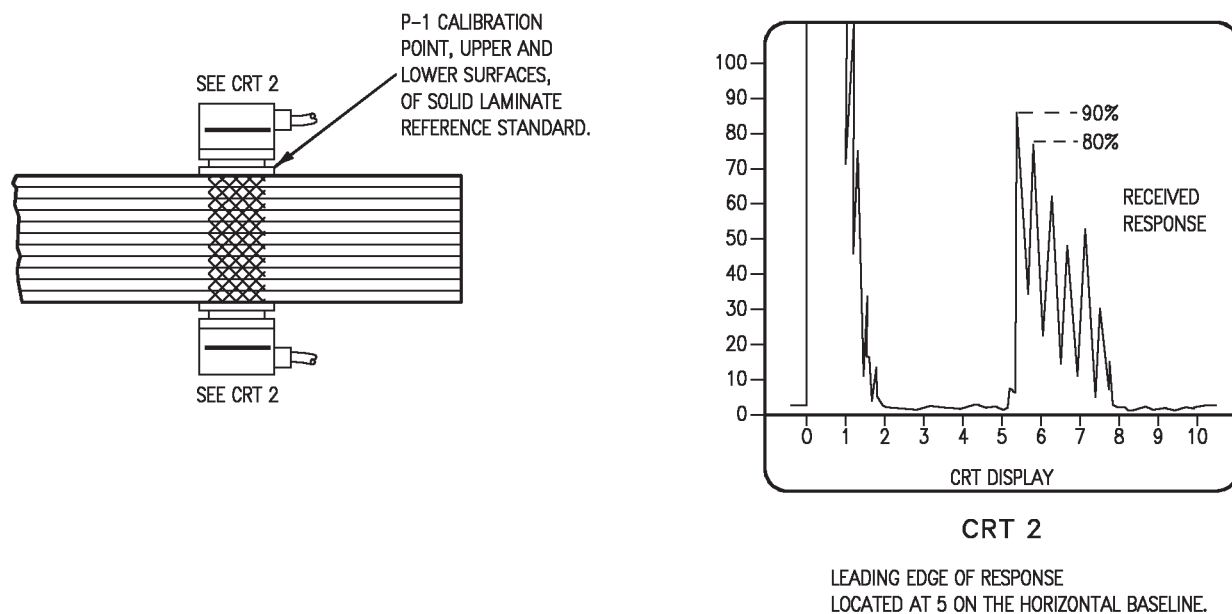
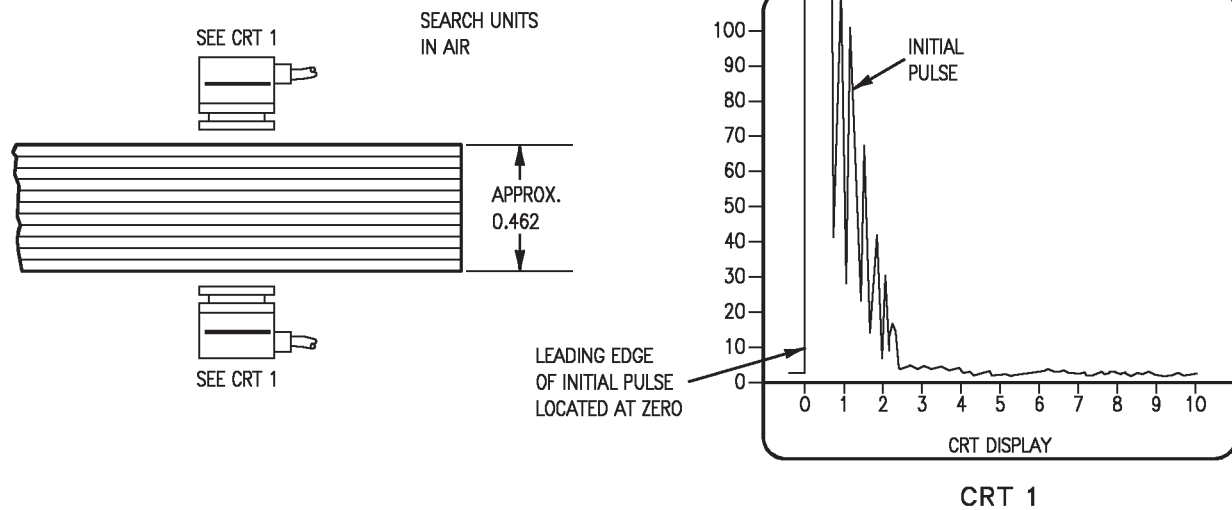


CRT 3

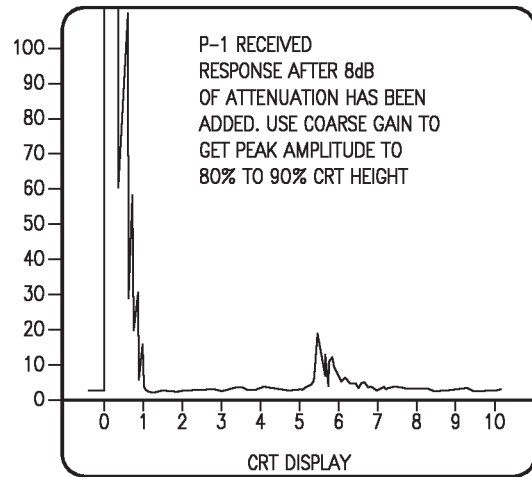
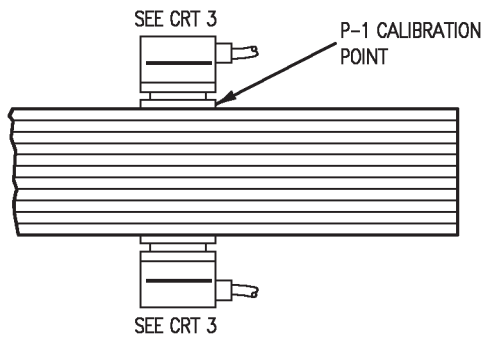
18AC-SRM-310-(226-1)01-SCAN

Figure 6. Typical Delamination and Unbond Responses

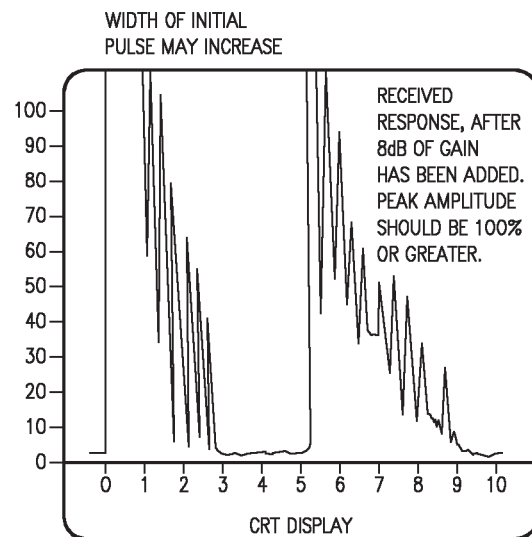
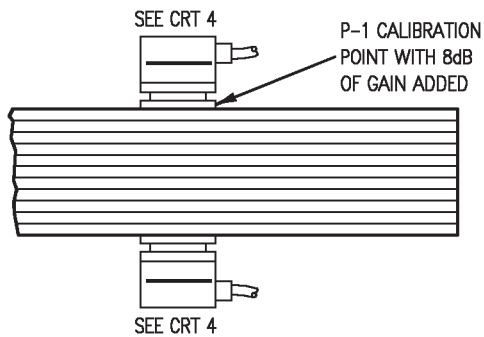




**Figure 7. Standardization For Solid Laminate and Former Areas With Thicknesses Greater Than 0.190 (Sheet 1)**



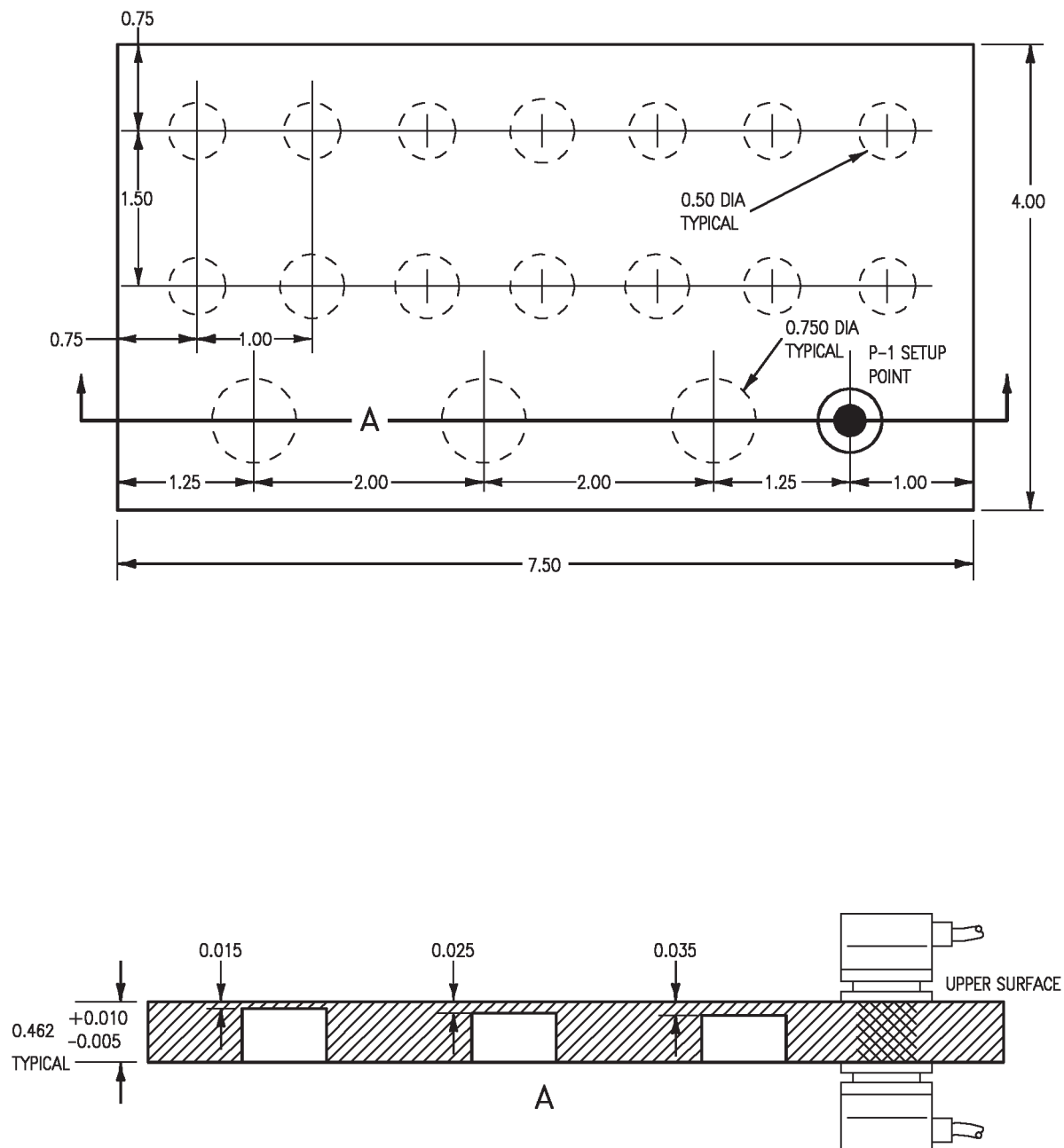
CRT 3



CRT 4

LEADING EDGE OF RECEIVED RESPONSE  
SHOULD STILL BE LOCATED AT 4.

**Figure 7. Standardization For Solid Laminate and Former Areas With Thicknesses Greater Than 0.190 (Sheet 2)**



74D111295-1009

GRAPHITE EPOXY

FLAT BOTTOM HOLE REFERENCE  
STANDARD FOR LAMINATES TO  
0.450 INCH.

Figure 8. FBH Reference Standard For Solid Laminate Setup

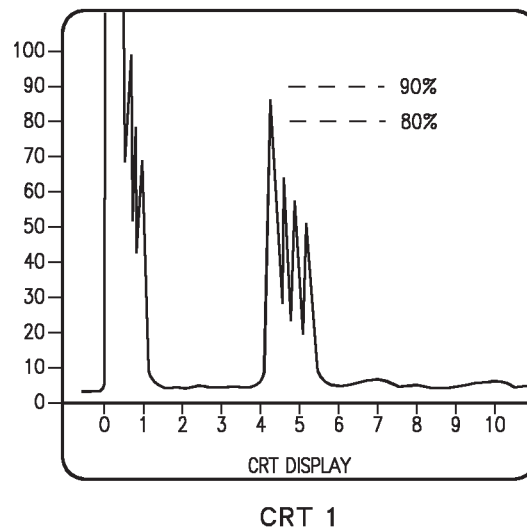
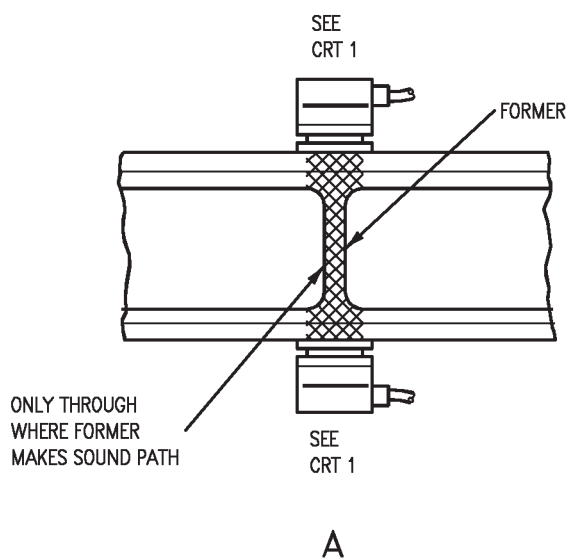
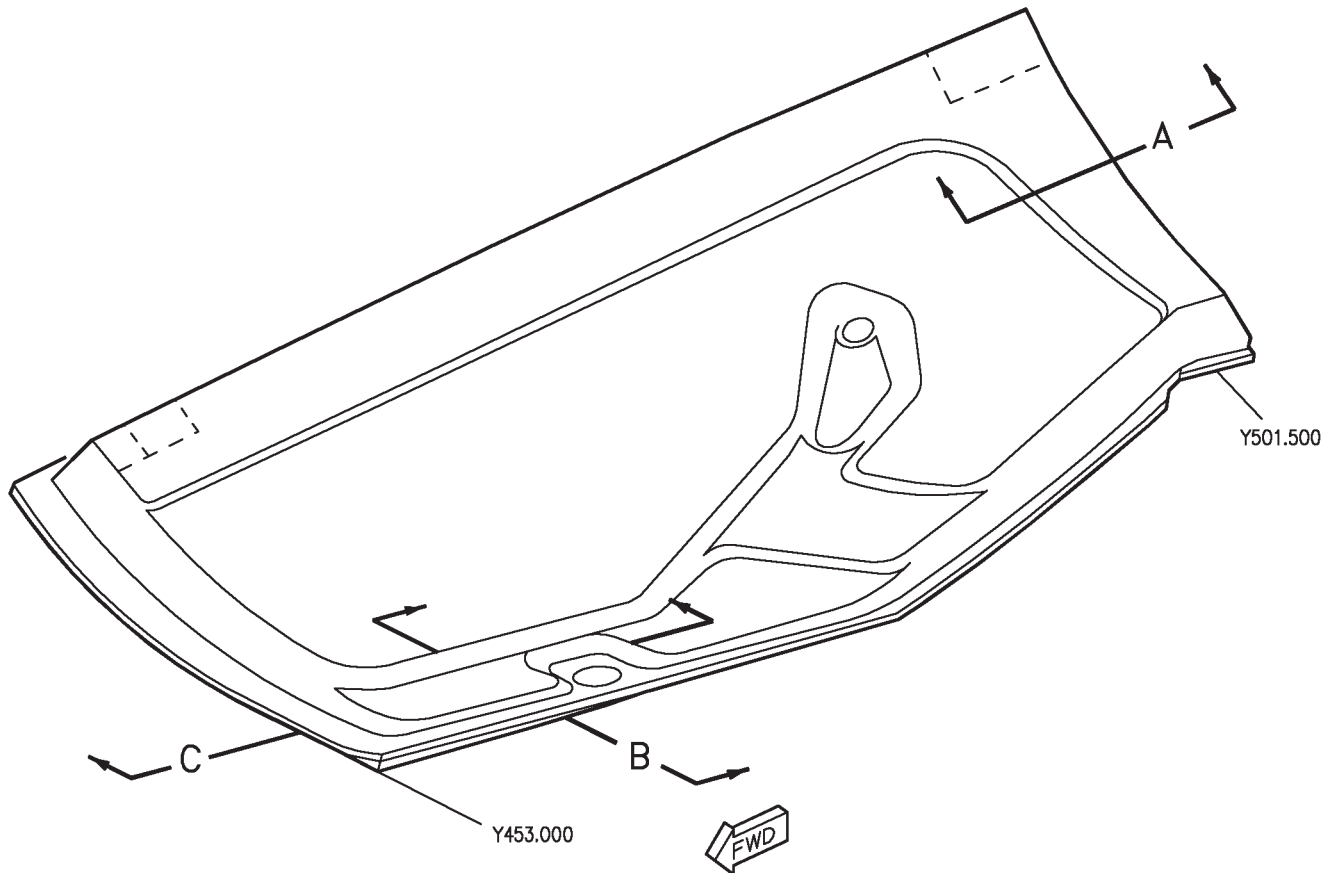


Figure 9. Inspection Responses For Solid Composite Laminate, Missile Fairing, and Former Areas Greater Than 0.190 (Sheet 1)

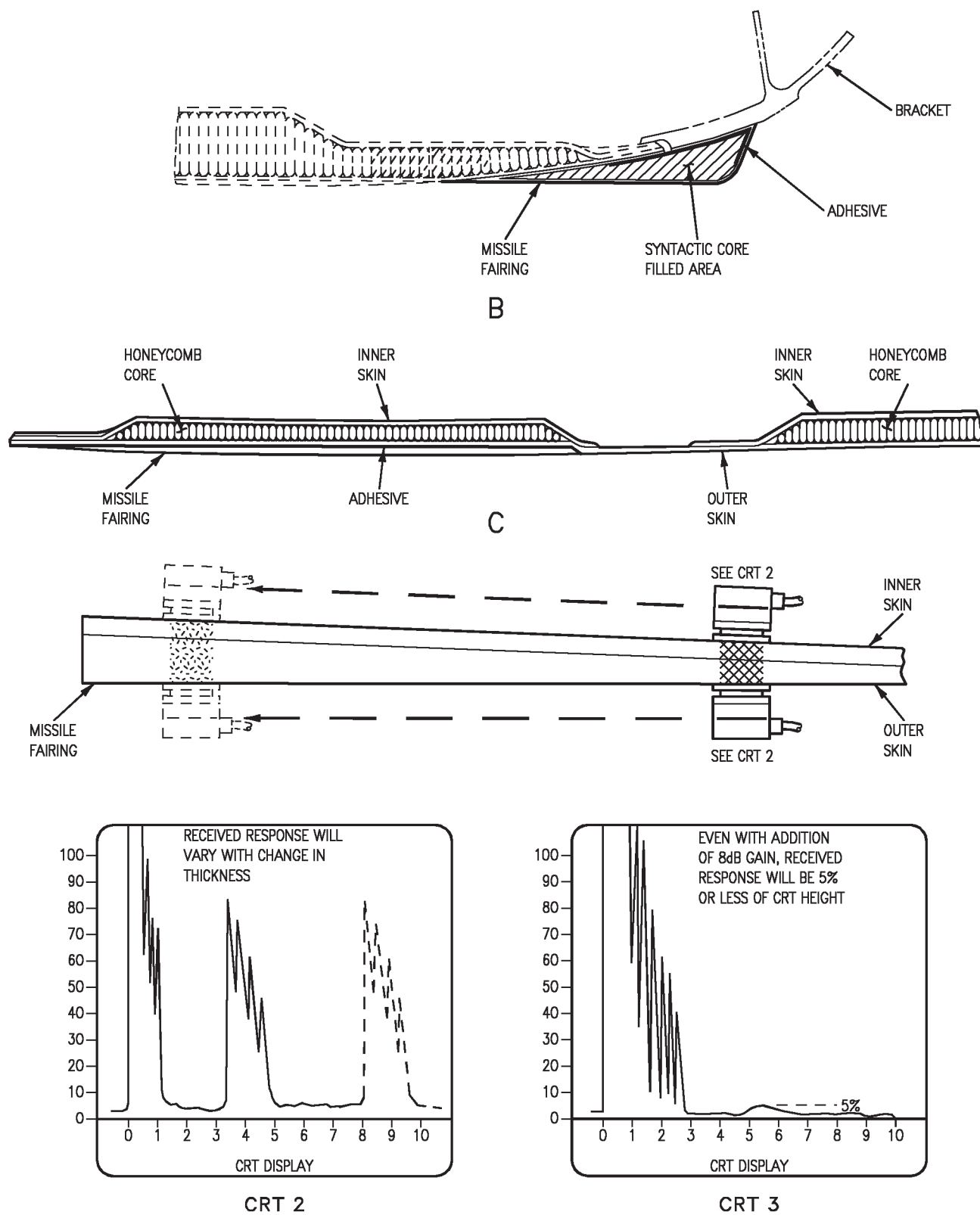


Figure 9. Inspection Responses For Solid Composite Laminate, Missile Fairing, and Former Areas Greater Than 0.190 (Sheet 2)

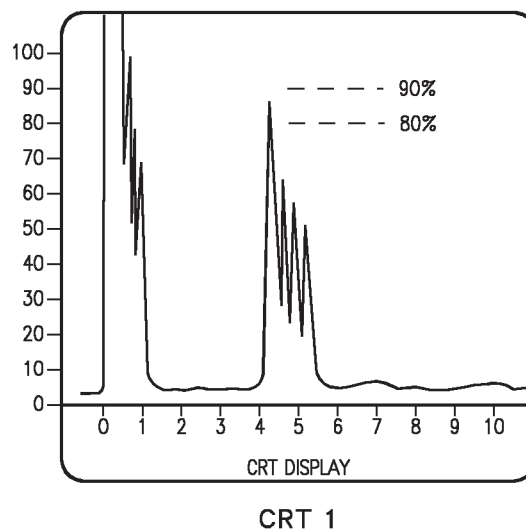
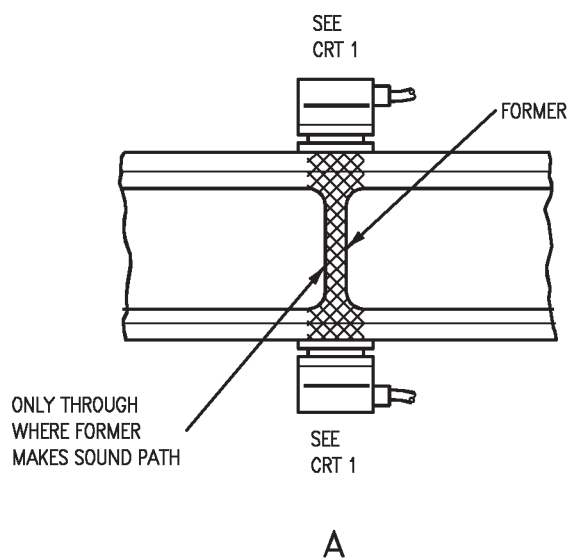
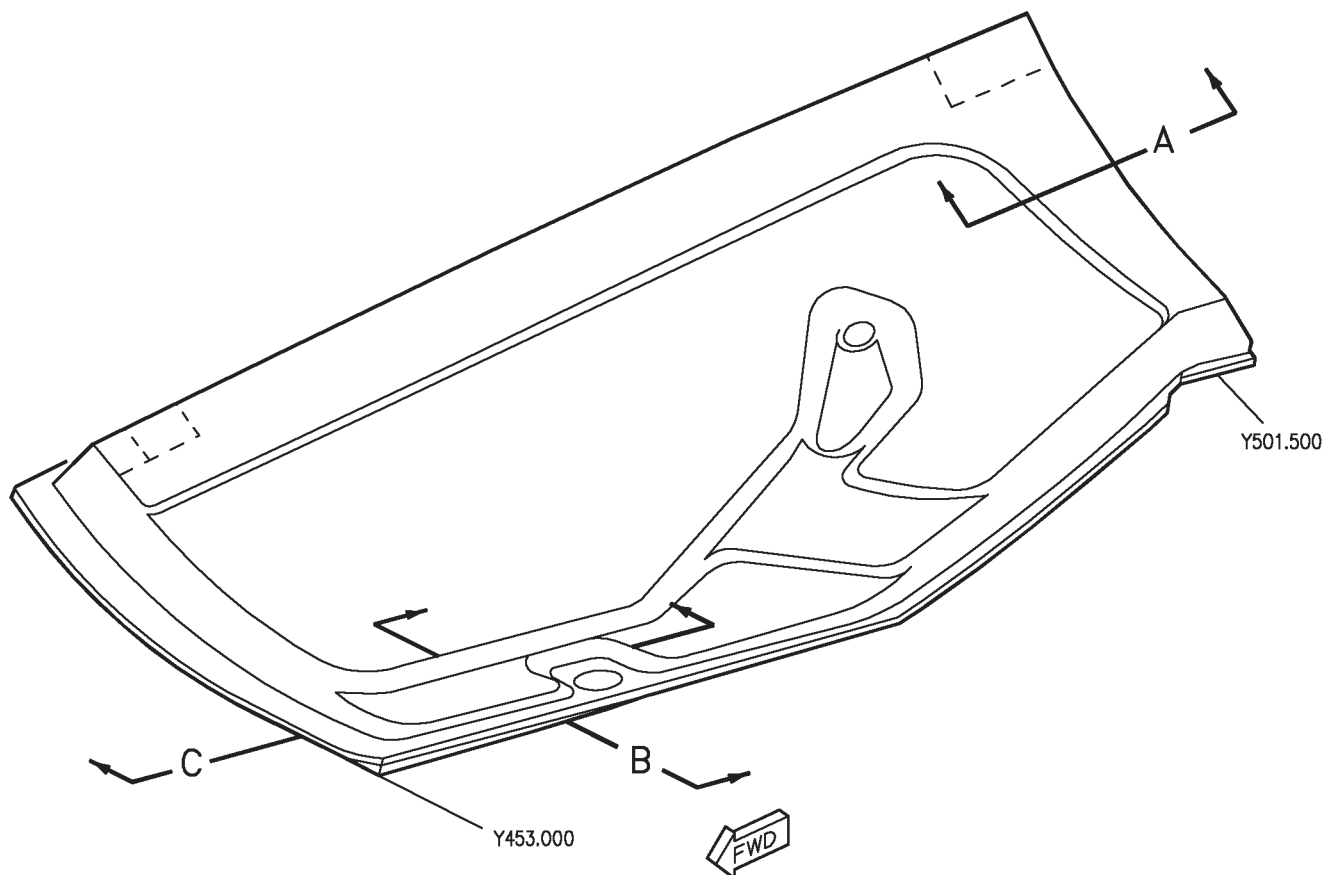


Figure 10. Inspection Response for Thick Laminate and Missile Fairing Areas (Sheet 1)

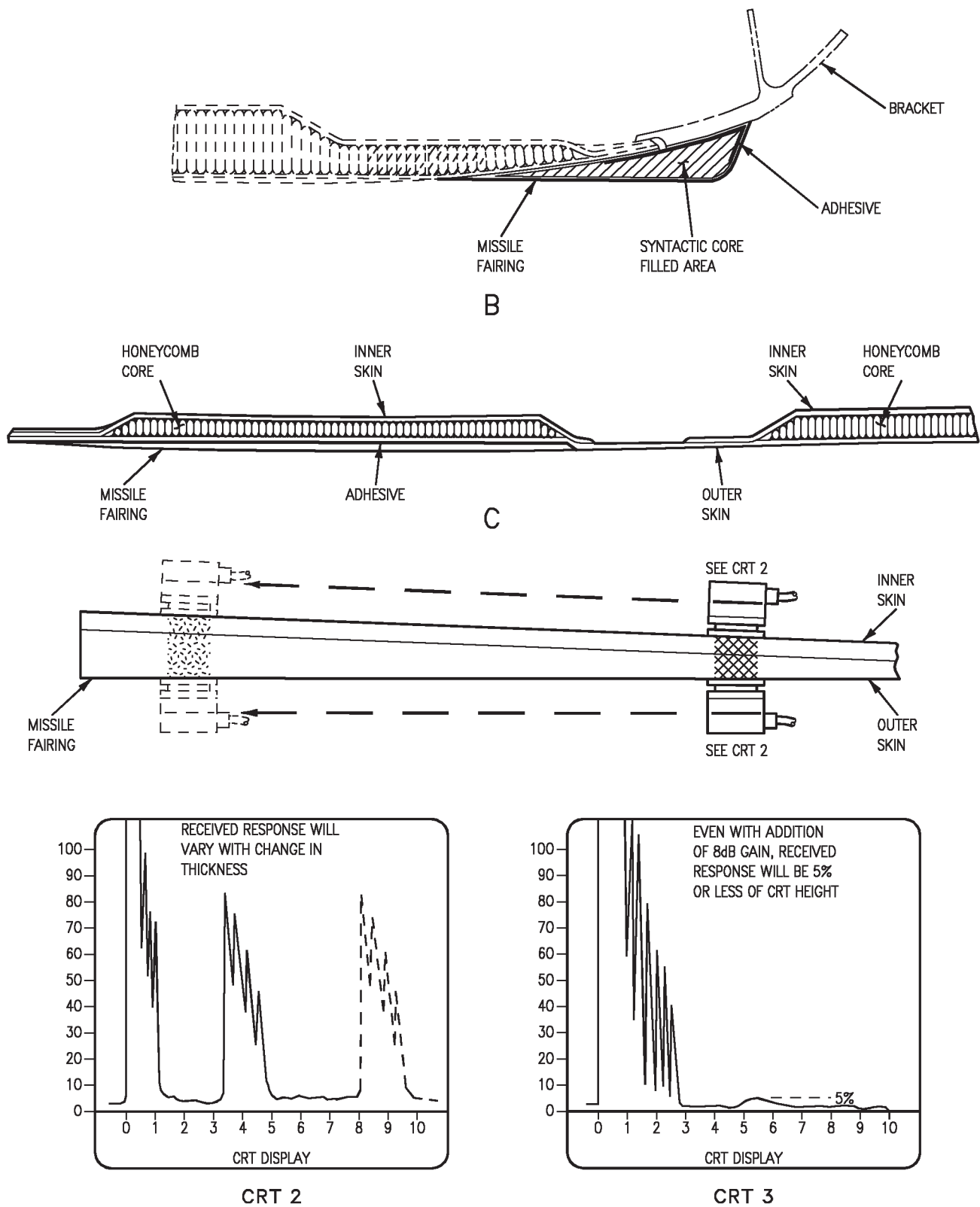
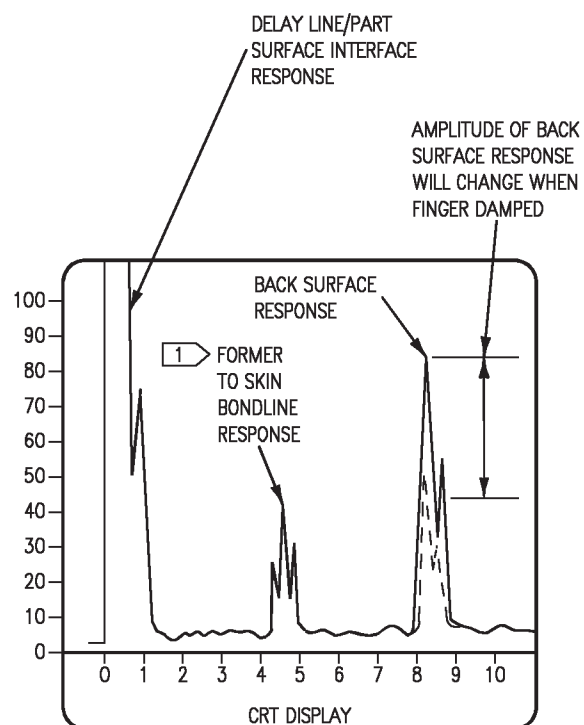
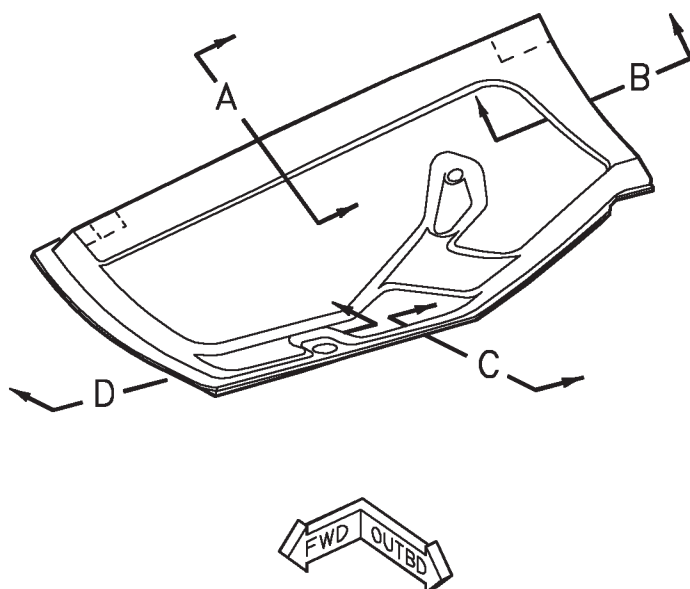
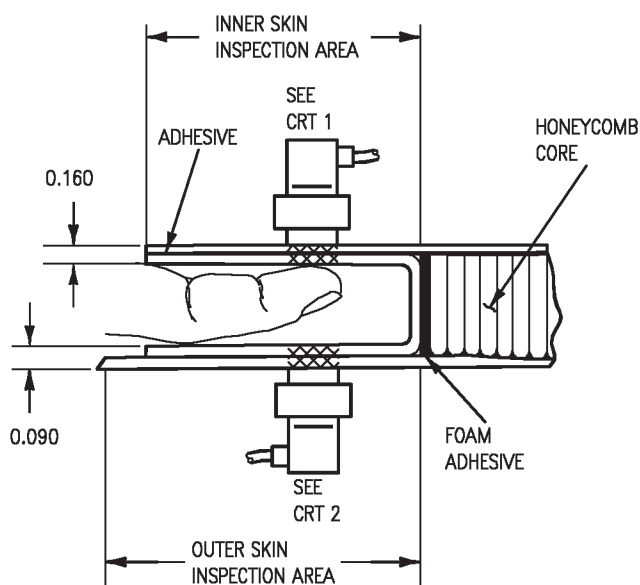


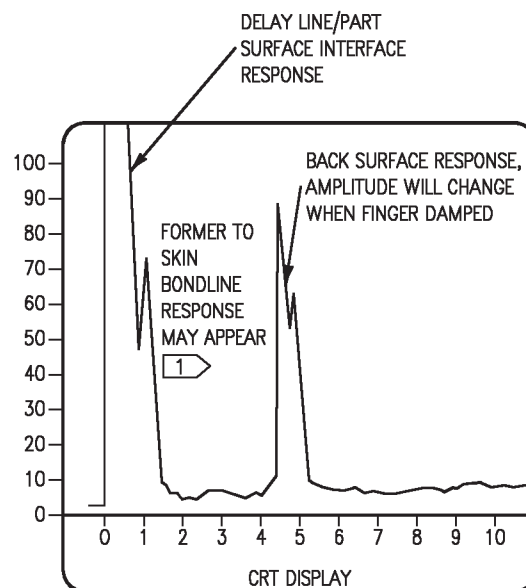
Figure 10. Inspection Response for Thick Laminate and Missile Fairing Areas (Sheet 2)



CRT 1



A



CRT 2

Figure 11. Good Responses (Sheet 1)



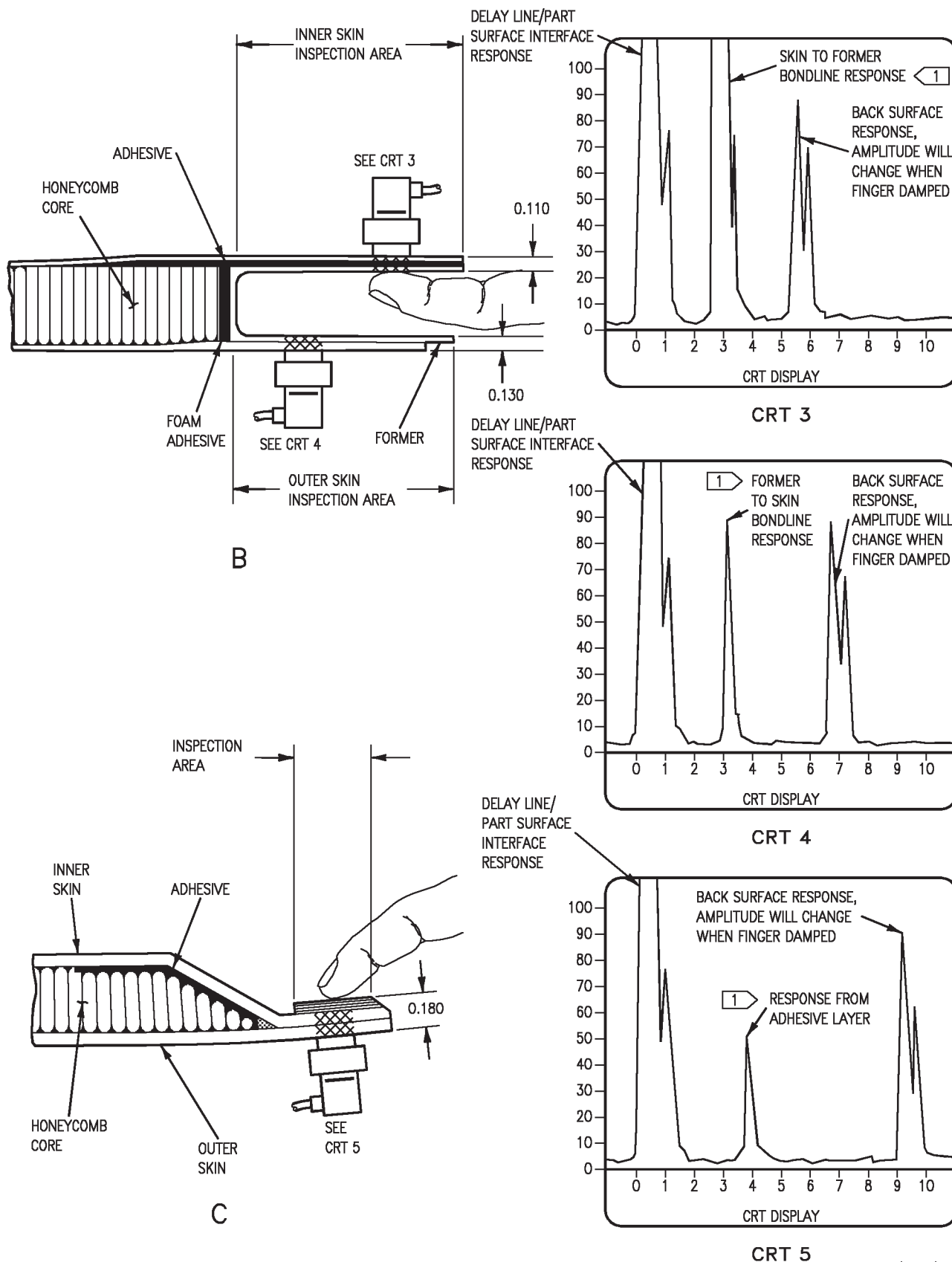
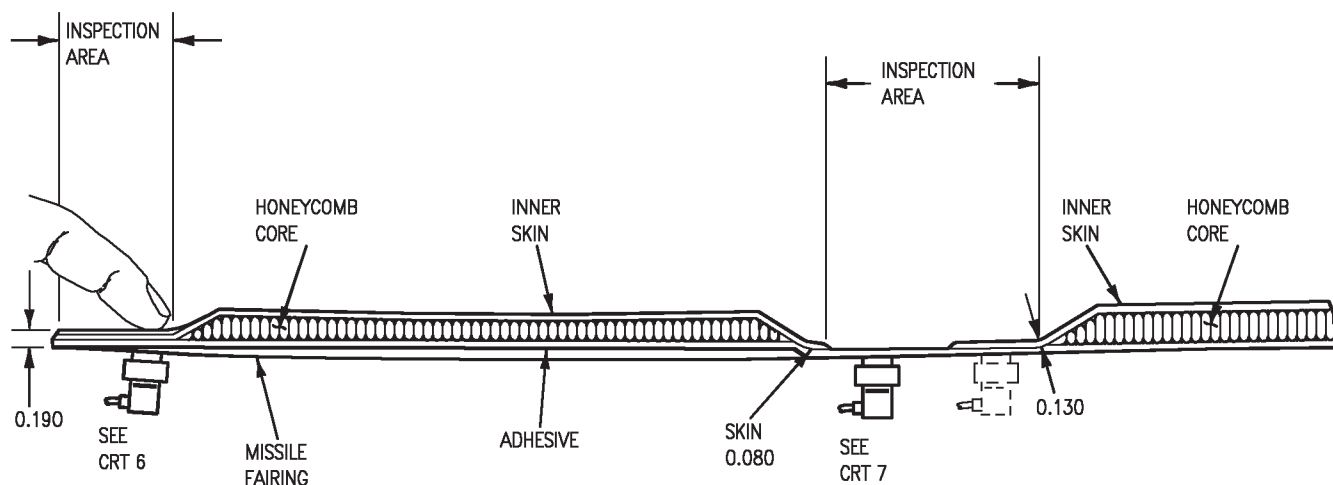
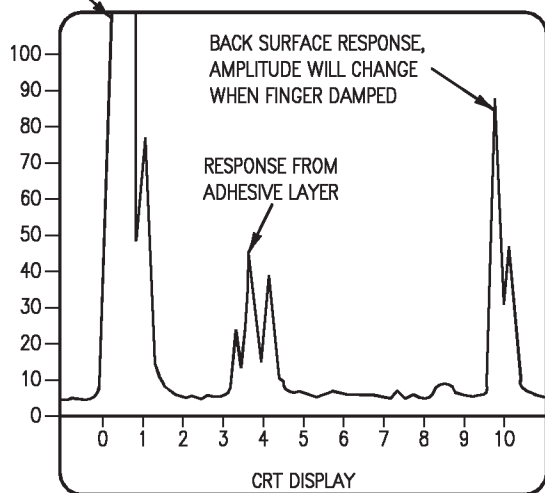


Figure 11. Good Responses (Sheet 2)



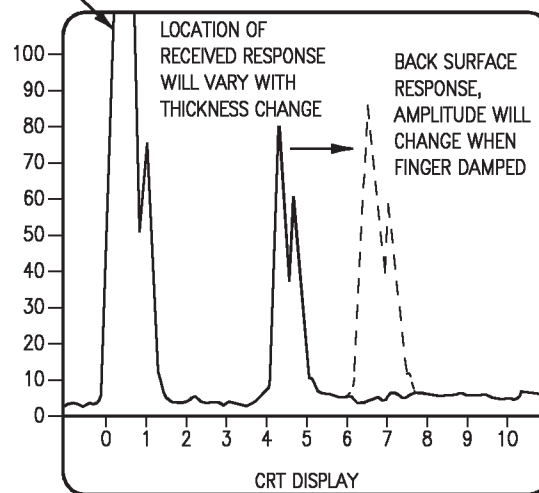
D

DELAY LINE/PART  
SURFACE INTERFACE  
RESPONSE



CRT 6

DELAY LINE/PART  
SURFACE INTERFACE  
RESPONSE

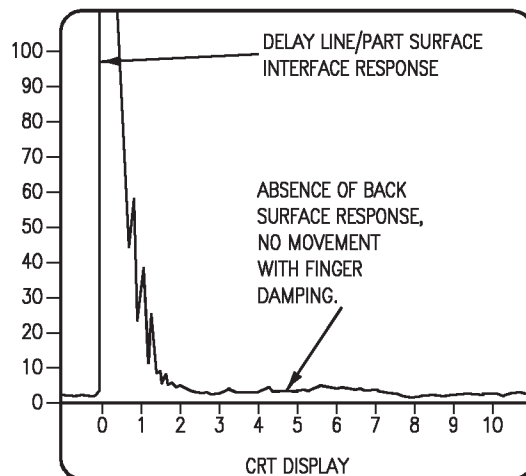
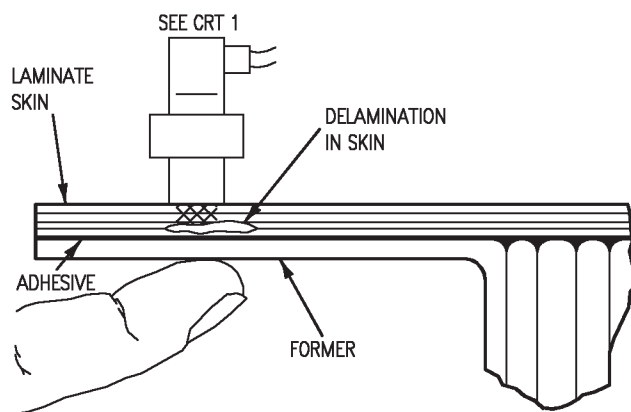


CRT 7

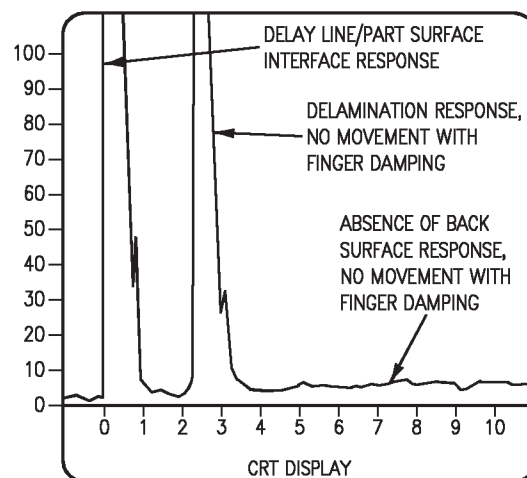
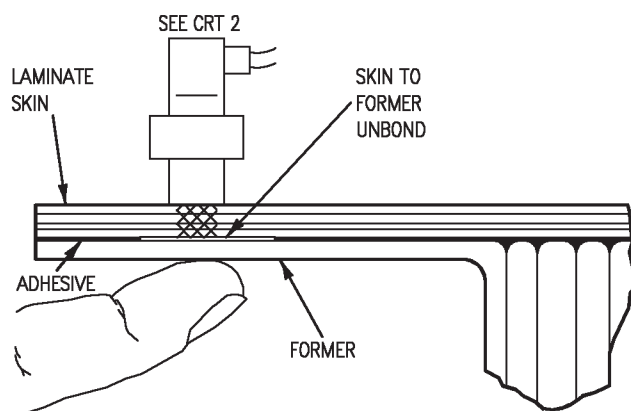
## LEGEND

- 1 AMPLITUDE AND LOCATION OF RESPONSE MAY DIFFER FROM DISPLAY SHOWN, BUT WILL NOT CHANGE WHEN BACK SURFACE IS DAMPED.

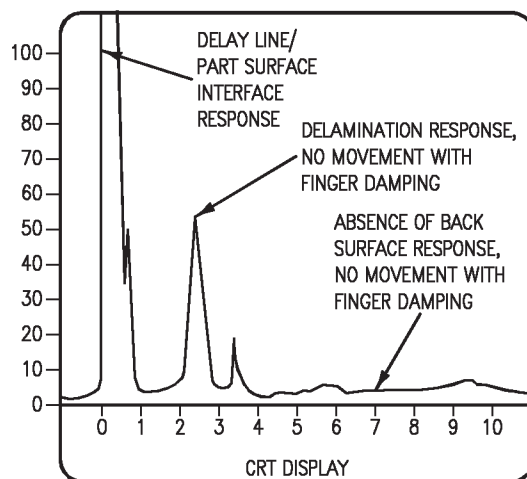
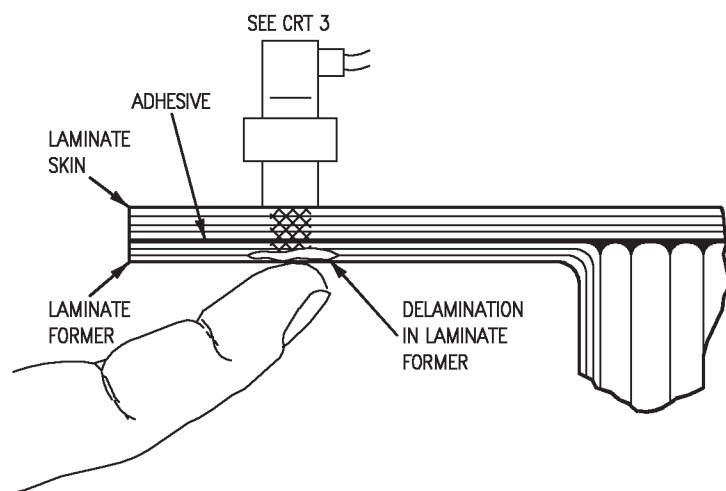
Figure 11. Good Responses (Sheet 3)



CRT 1



CRT 2



CRT 3

18AC-SRM-310-(232-1)01-SCAN

Figure 12. Unbond Responses



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**INTERMEDIATE MAINTENANCE****NONDESTRUCTIVE INSPECTION****FORWARD AND CENTER FUSELAGE; UPPER BONDED HONEYCOMB DOORS****SKIN TO CORE UNBONDS AND EDGE DELAMINATIONS****DOOR 18 PART NO. 74A314073****DOOR 26 PART NO. 74A321644****DOOR 26 PART NO. 74A321661****DOOR 31 PART NO. 74A321671****DOOR 40 PART NO. 74A324657****DOOR 43 PART NO. 74A324662****DOOR 49 PART NO. 74A324667**

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**Reference Material**

Plane Captain Manual .....	A1-F18AC-PCM-000
Naval Aviation Maintenance Program .....	OPNAVINST 4790.2
Nondestructive Inspection.....	A1-F18AC-SRM-300
General Information .....	WP003 00
Ultrasonic Through Transmission Contact Testing, Standardization, and Inspection Procedures for Composite Laminate Skins Bonded to Honeycomb Core.....	WP008 01
Pulse-Echo, Longitudinal Wave Contact, with Delay Line, for Composite Laminate Material .....	WP008 03
Pulse-Echo, Longitudinal Wave Contact, with Delay Line, for Composite Laminate Material Bonded to Honeycomb Core .....	WP008 04
Ultrasonic Through Transmission Contact Testing, Standardization and Inspection Procedures for Composite Laminate and Metallic Skins Bonded to Honeycomb Core .....	WP008 10
Pulse-Echo Longitudinal, Contact, Without Delay Line, for Composite Laminate Materials.....	WP008 11
Pulse-Echo Longitudinal Contact, With Delay Line, for Composite Laminate Materials.....	WP008 12
Pulse-Echo Longitudinal, Contact, With Delay Line, for Composite Laminate Material Bonded to Honeycomb Core .....	WP008 13

## Alphabetical Index

Subject	Page No.
Forward and Center Fuselage, Upper Doors.....	2
Defects .....	2
Post Inspection Cleaning and Corrosion Control.....	6
Primary Inspection Method .....	2
Ultrasonic Method Using C-398 Ultrasonic Flaw Detector .....	2
Ultrasonic Method Using MXU-715/E Ultrasonic Flaw Detector .....	4

## Record of Applicable Technical Directives

None

1. FORWARD AND CENTER FUSELAGE,  
UPPER BONDED HONEYCOMB DOORS.

2. See figure 1. Forward and center fuselage upper bonded honeycomb doors (dorsal deck doors) are bonded flexible honeycomb assemblies. Flexible honeycomb core is 5056 aluminum alloy. Skin to core bonds are made with FM-300 film adhesive. Skin is graphite epoxy with epoxy primer and polyurethane coating finish system.

3. **DEFECTS.** Inspect for skin to core unbonds and edge delaminations. Examples of skin to core unbonds and delaminations that may develop in bonded assembly are contained in (WP003 00).

4. **PRIMARY INSPECTION METHOD.** Primary inspection method is ultrasonic through transmission and pulse-echo.

5. **Personnel Qualifications.** Personnel doing this nondestructive inspection shall be qualified and certified to do ultrasonic inspections per OPNAVINST 4790.2 SERIES, NDI Technicians, NEC 7225/MOS 6044.

6. **Preparation of Aircraft.** No special preparation required.

7. **Access.** No special access required.

8. ULTRASONIC METHOD USING C-398  
ULTRASONIC FLAW DETECTOR.

## Support Equipment Required

## NOTE

Alternate item type designations or part numbers are listed in parentheses.

Part Number or Type Designation	Nomenclature
C-398 (303B)	Ultrasonic Flaw Detector.
57A2271 or EQUIVALENT	Microdot to BNC Connecting Cable, 2 Reqd.
57A2276 or EQUIVALENT	0°, 0.500 Dia., 2.25 MHz, Contact Search Unit, 2 Reqd.
74D110175-1001	Graphite Epoxy Reference Standard Set Containing the Following:
74D111295-1009	Graphite Epoxy Flat Bottom Hole Reference Standard for Laminates up to 0.450 Inch

## Support Equipment Required (Continued)

Part Number or Type Designation	Nomenclature
74D111295-1005	Honeycomb Reference Standard With Graphite Epoxy Skin for Sandwich Assemblies Less Than 1 Inch

## Materials Required

### NOTE

Alternate item specifications or part numbers are shown indented.

Specification or Part Number	Nomenclature
ULTRAGEL II or EQUIVALENT	Couplant
MIL-P-83953-2, TYPE 1, CLASS A or B, BLACK or RED	Aircraft Marking Pencil
P-D-680 TYPE 2 D 1153	Dry Cleaning Solvent Methyl Isobutyl Ketone
CCC-C-46, TYPE 1, CLASS 4	Cleaning Cloth

### 9. Preparation of Part.

#### WARNING

Dry cleaning solvent and methyl isobutyl ketone are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

- Clean inspection area with solvent moistened cloth to make sure inspection area is free of contamination or foreign material.

- On doors locate, mark, and identify inspection areas, and boundaries as shown in figure 1.

#### WARNING

Make sure safety precautions have been met for electrical, static, grounding when using ultrasonic equipment near aircraft fuel cells, oxygen systems, electronic systems, and stores (A1-F18AC-PCM-000).

### 10. Equipment Settings/Standardization/Setup for Skin to Core Areas.

See figures 2 and 3. Do standardization per (WP008 01), except as below:

- Use two 57A2276 search units.
- Use P-1 calibration point on applicable 74D111295-1005 graphite/epoxy skinned honeycomb core sandwich assembly reference standard.

### 11. Inspection Procedure for Skin to Core Areas.

See figure 3. After standardization, inspect skin to core area of applicable door(s) per (WP008 01), except as below:

- Use two 57A2276 search units.
- Apply couplant to both surfaces of inspection area(s).
- Make sure initial pulse width does not interfere with location of received response. If required, switch position of search units on microdot cables or use different search unit on receiver cable.
- Use ultrasonic pulse-echo per (WP008 04) to determine if suspect areas are result of skin delaminations. Do pulse-echo inspection on both surfaces to help identify location of flaw(s) causing through transmission unbond response. See figure 4 to identify skin thicknesses.

**WARNING**

12. **Equipment Settings/Standardization/Setup for Solid Laminate Area.** Do standardization for laminates less than 0.450 thick per (WP008 02) making sure trailing edge of initial pulse is located at less than 1 large division when 0.100 inch FBH response is 80 to 90 percent CRT height.

13. **Inspection Procedure for Solid Laminate Area.** See figures 4 and 5. Inspect solid laminate areas per (WP008 03) and below:

- a. Apply couplant to solid laminate inspection area where laminate thickness is known.
- b. Make sure leading edge of back surface response is located at correct location on horizontal baseline when peak amplitude is 80 to 90 percent CRT height.
- c. Scan area to be inspected, finger damping back surface response often, as required, to make sure correct response is being received. Finger damp by placing couplant on end of finger and touching opposite surface. As finger touches and is then removed from part surface, reflected response on CRT will move up and down as it is damped, indicating good bond. For example, see figures 6 and 7.
- d. For inspection responses in addition to those described in (WP008 03), refer to figure 8.
- e. Use pulse-echo mapping techniques per (WP008 03) to determine extent of flaw indication.

f. Do paragraph 20.

14. **ULTRASONIC METHOD USING MXU-715/E  
ULTRASONIC FLAW DETECTOR.**

**Support Equipment Required**

Part Number or Type Designation	Nomenclature
1642AS100-1	Ultrasonic Flaw Detector, MXU-715/E, Magnaflux

**Support Equipment Required  
(Continued)**

Part Number or Type Designation	Nomenclature
57A2271 or EQUIVALENT	Microdot to BNC Connecting Cable, 2 Req'd.
57A2276 or EQUIVALENT	0°, 0.500 Dia., 2.25 MHz, Contact Search Unit, 2 Req'd.
74D110175-1001	Graphite Epoxy Reference Standard Set Containing the Following:
74D111295-1009	Graphite Epoxy Flat Bottom Hole Reference Standard for Laminates up to 0.450 Inch
74D111295-1005	Honeycomb Reference Standard With Graphite Epoxy Skin for Sandwich Assemblies Less Than 1 Inch

**Materials Required**

**NOTE**

Alternate item specifications or part numbers are shown indented.

Specification or Part Number	Nomenclature
ULTRAGEL II or EQUIVALENT	Couplant
MIL-P-83953-2, TYPE 1, CLASS A or B, BLACK or RED	Aircraft Marking Pencil
P-D-680 TYPE 2	Dry Cleaning Solvent



**Materials Required (Continued)**

Specification or Part Number	Nomenclature
D 1153	Methyl Isobutyl Ketone
CCC-C-46, TYPE 1, CLASS 4	Cleaning Cloth

**15. Preparation of Part.****WARNING**

Dry cleaning solvent and methyl isobutyl ketone are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

a. Clean inspection area with solvent moistened cloth to make sure inspection area is free of contamination or foreign material.

b. On doors locate, mark, and identify inspection areas, and boundaries as shown in figure 1.

**WARNING**

Make sure safety precautions have been met for electrical, static, grounding when using ultrasonic equipment near aircraft fuel cells, oxygen systems, electronic systems, and stores (A1-F18AC-PCM-000).

**16. Equipment Settings/Standardization/Setup for Skin to Core Areas.** See figures 2 and 3. Do standardization per (WP008 10), except as below:

a. Use two 57A2276 search units.

b. Use P-1 calibration point on applicable 74D111295-1005 graphite/epoxy skinned honeycomb core sandwich assembly reference standard.

**17. Inspection Procedure for Skin to Core Areas.** See figure 3. After standardization, inspect skin to core area of applicable door(s) per (WP008 10), except as below:

a. Use two 57A2276 search units.

b. Apply couplant to both surfaces of inspection area(s).

c. Make sure initial pulse width does not interfere with location of received response. If required, switch position of search units on microdot cables or use different search unit on receiver cable.

d. Use ultrasonic pulse-echo per (WP008 13) to determine if suspect areas are result of skin delaminations. Do pulse-echo inspection on both surfaces to help identify location of flaw(s) causing through transmission unbond response. See figure 4 to identify skin thicknesses.

**WARNING**

**18. Equipment Settings/Standardization/Setup for Solid Laminate Area.** Do standardization for laminates less than 0.450 thick per (WP008 11) making sure trailing edge of initial pulse is located at less than 1 large division when 0.100 inch FBH response is 80 to 90 percent CRT height.

**19. Inspection Procedure for Solid Laminate Area.** See figures 4 and 5. Inspect solid laminate areas per (WP008 12) and below:

a. Apply couplant to solid laminate inspection area where laminate thickness is known.

b. Make sure leading edge of back surface response is located at correct location on horizontal baseline when peak amplitude is 80 to 90 percent CRT height.

c. Scan area to be inspected, finger damping back surface response often, as required, to make sure correct response is being received. Finger damp

by placing couplant on end of finger and touching opposite surface. As finger touches and is then removed from part surface, reflected response on CRT will move up and down as it is damped, indicating good bond. For example, see figure 6 and 7.

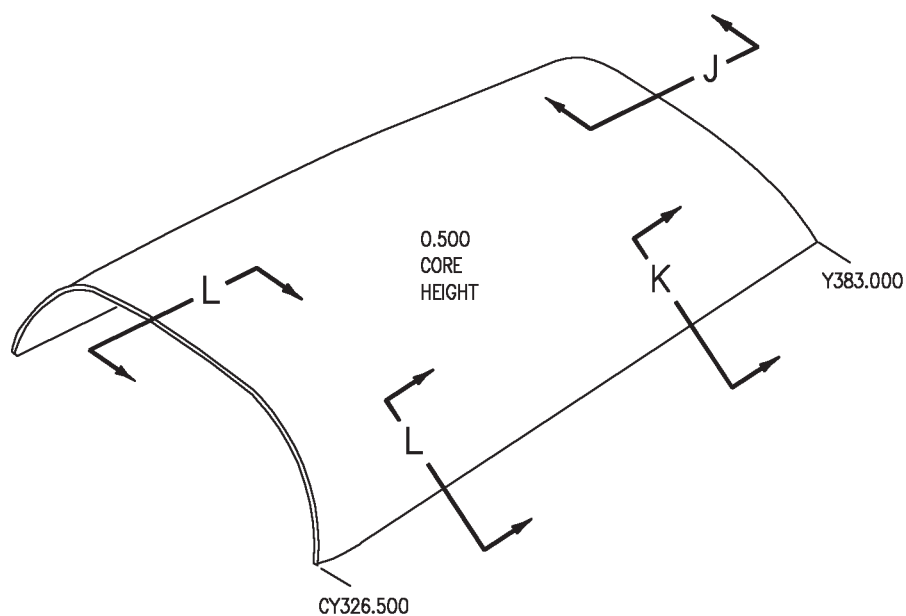
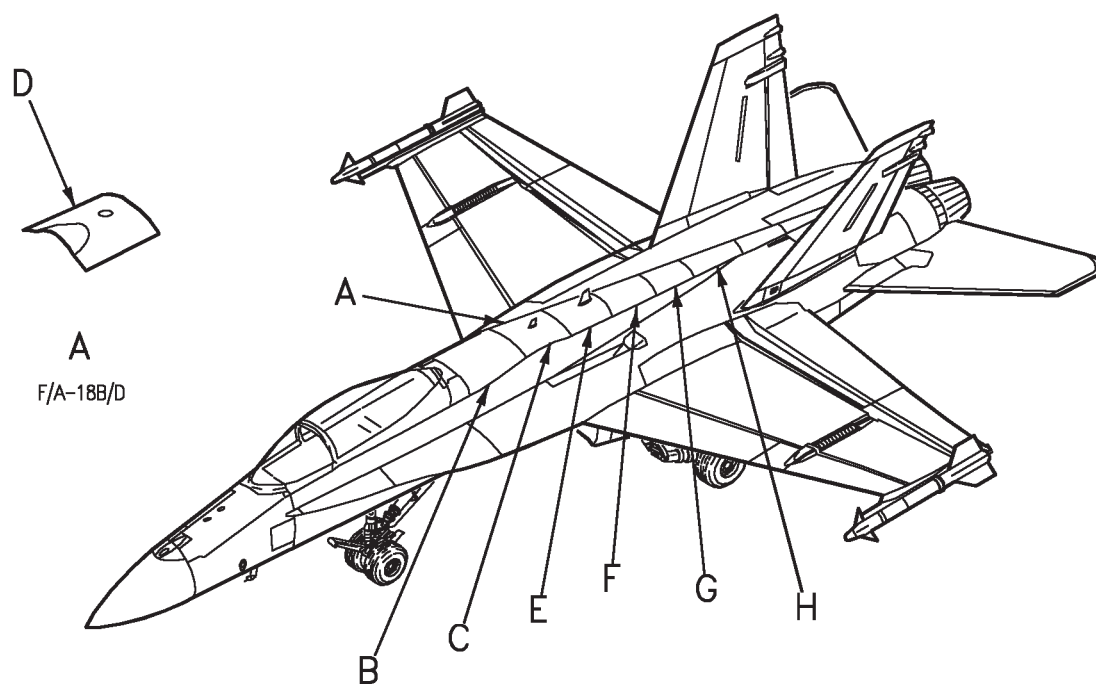
d. For inspection responses in addition to those described in (WP008 12), refer to figure 8.

e. Use pulse-echo mapping techniques per (WP008 12) to determine extent of flaw indication.

## WARNING

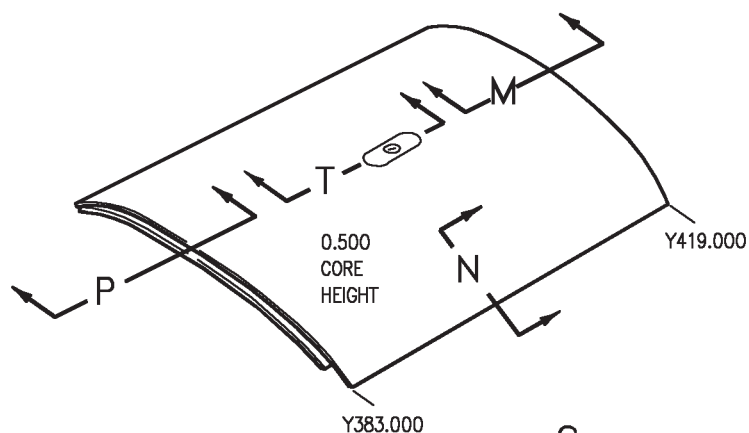
Dry cleaning solvent and methyl isobutyl ketone are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

**20. POST INSPECTION CLEANING AND CORROSION CONTROL.** After recording any defects, clean inspection marks and couplant from door(s) with solvent moistened cloth.

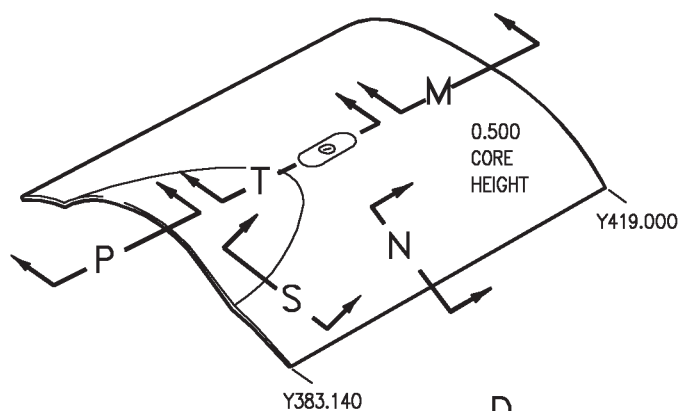


B  
DOOR 18  
F/A-18A/C

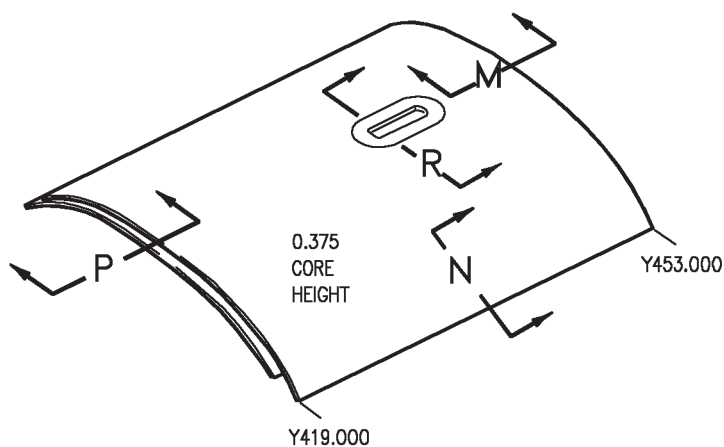
Figure 1. Location, Structure, and Core Height of Dorsal Deck Doors (Sheet 1)



C  
DOOR 26  
F/A-18A/C



D  
DOOR 26  
F/A-18B/D



E  
DOOR 31

Figure 1. Location, Structure, and Core Height of Dorsal Deck Doors (Sheet 2)

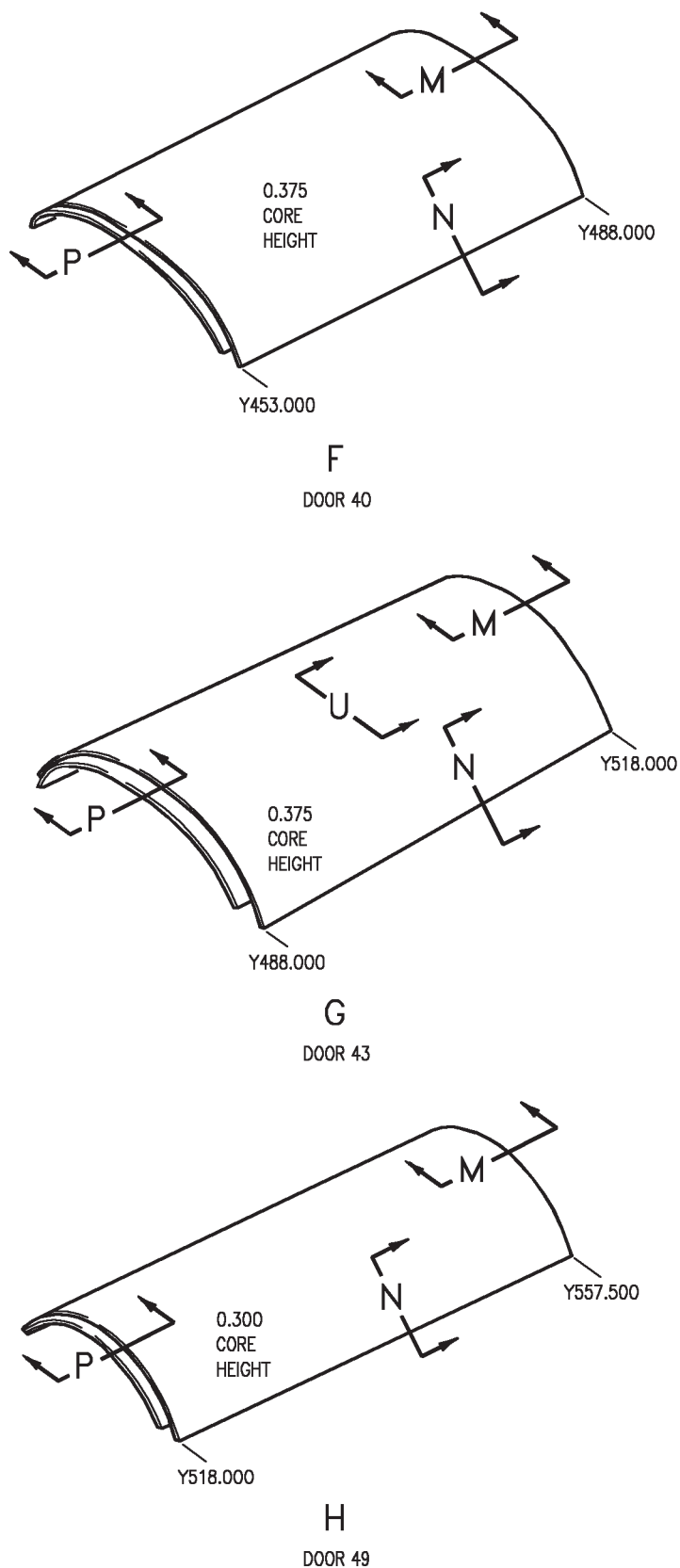


Figure 1. Location, Structure, and Core Height of Dorsal Deck Doors (Sheet 3)

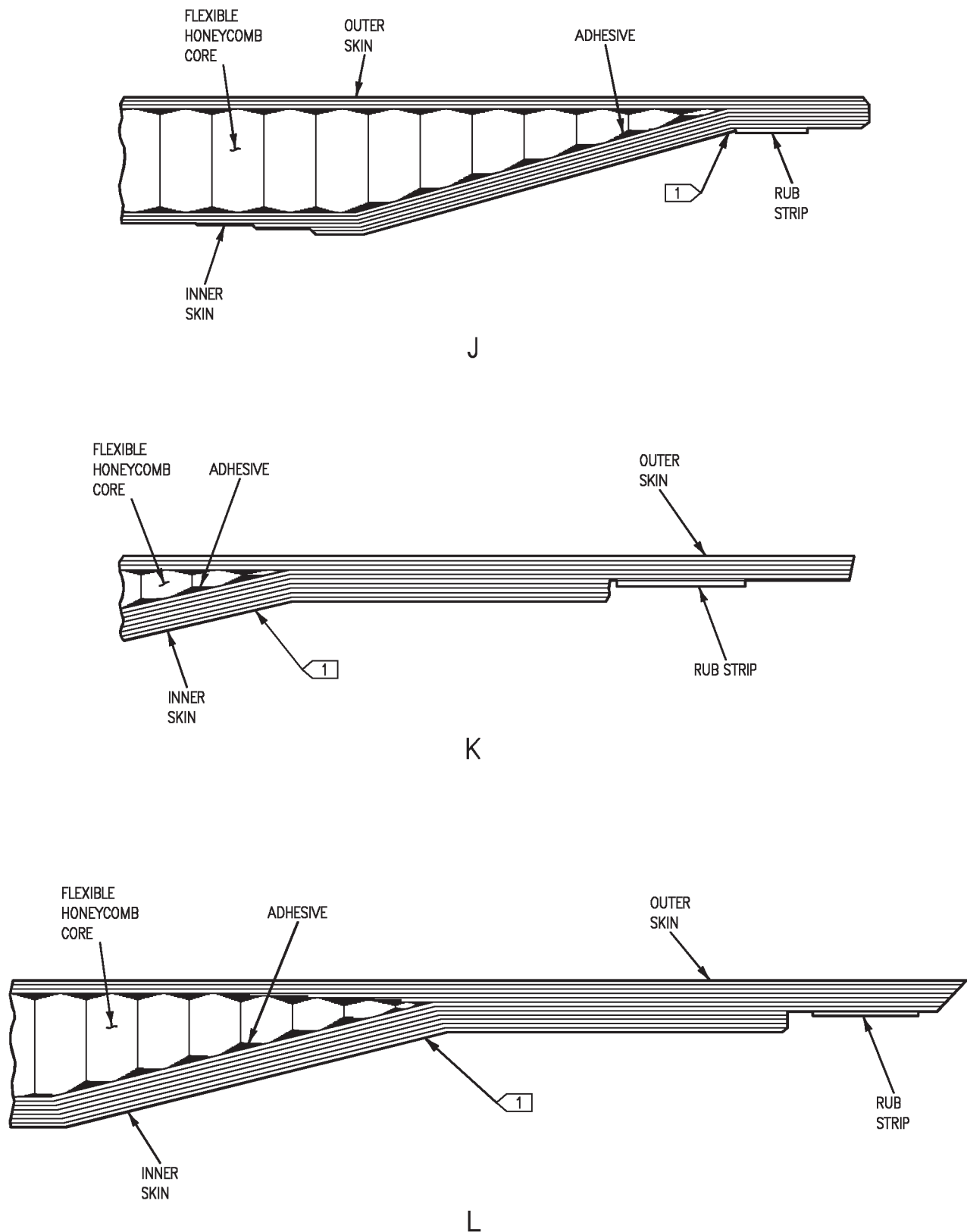


Figure 1. Location, Structure, and Core Height of Dorsal Deck Doors (Sheet 4)

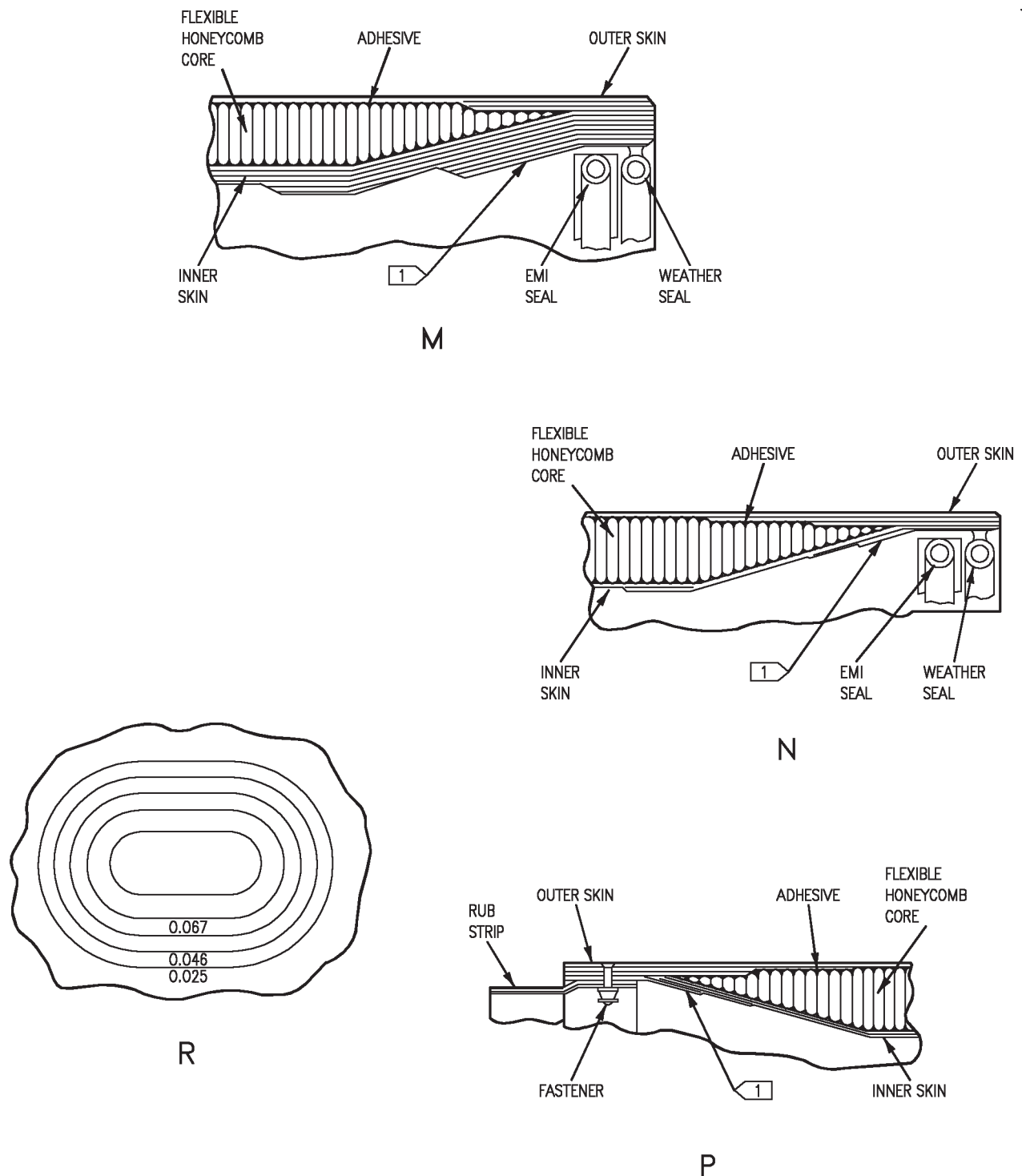


Figure 1. Location, Structure, and Core Height of Dorsal Deck Doors (Sheet 5)

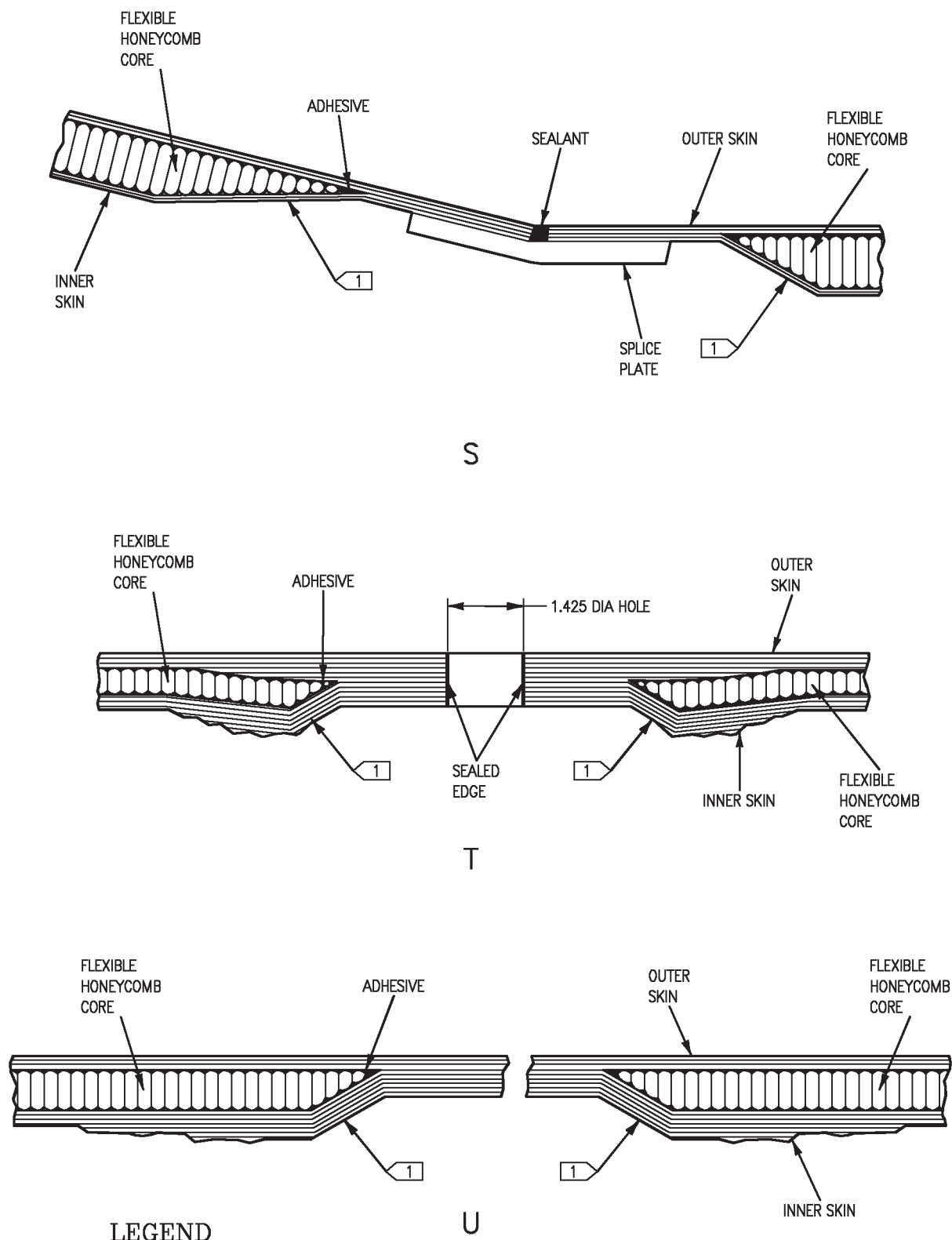
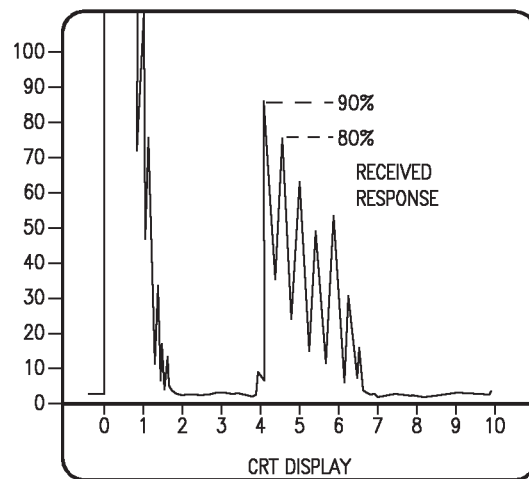
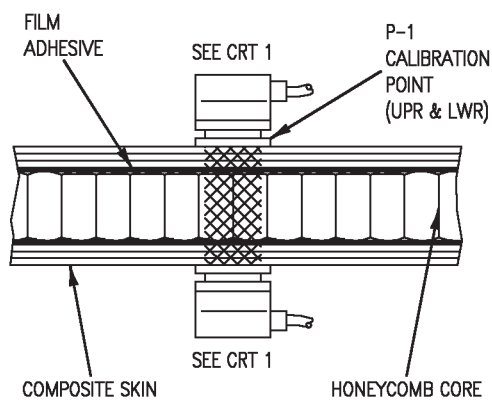


Figure 1. Location, Structure, and Core Height of Dorsal Deck Doors (Sheet 6)

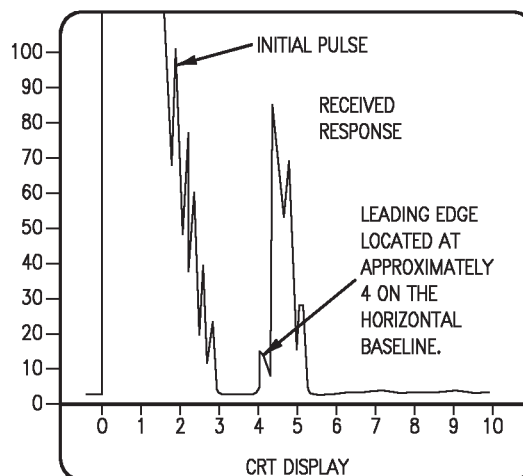
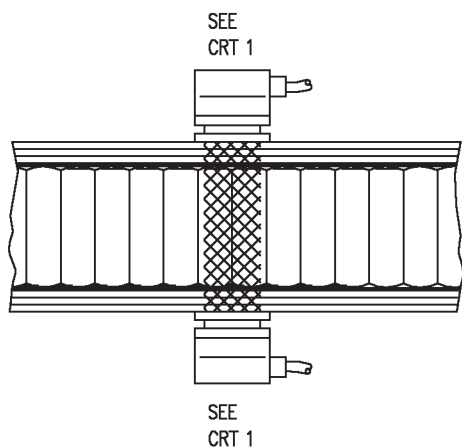




CRT 1

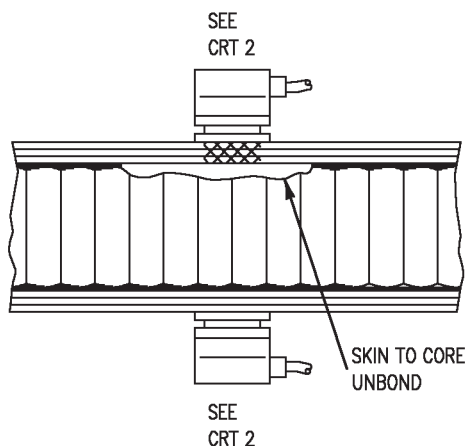
LEADING EDGE OF RECEIVED RESPONSE  
LOCATED AT 4 ON THE HORIZONTAL BASELINE.

**Figure 2. Standardization on One Half Inch Tall Graphite Epoxy Skinned  
Honeycomb Core Sandwich Assembly Reference Standard**

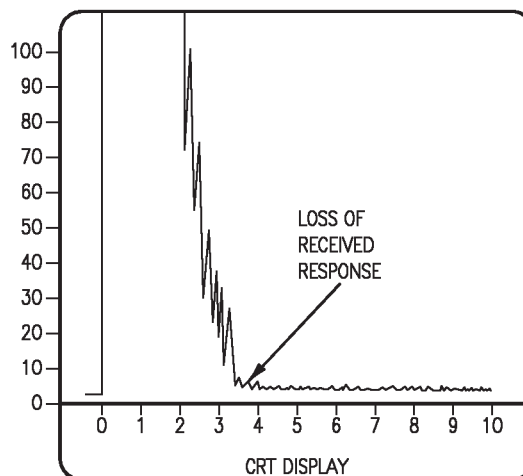
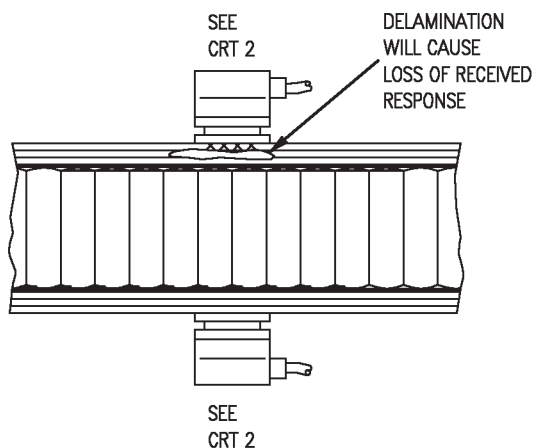


CRT 1

TYPICAL SKIN TO CORE AREA  
GOOD BOND RESPONSE.



OR



CRT 2

TYPICAL SKIN TO CORE AREA  
UNBOND RESPONSE.

**Figure 3. One Inch or Less Honeycomb Core Area Inspection Responses**

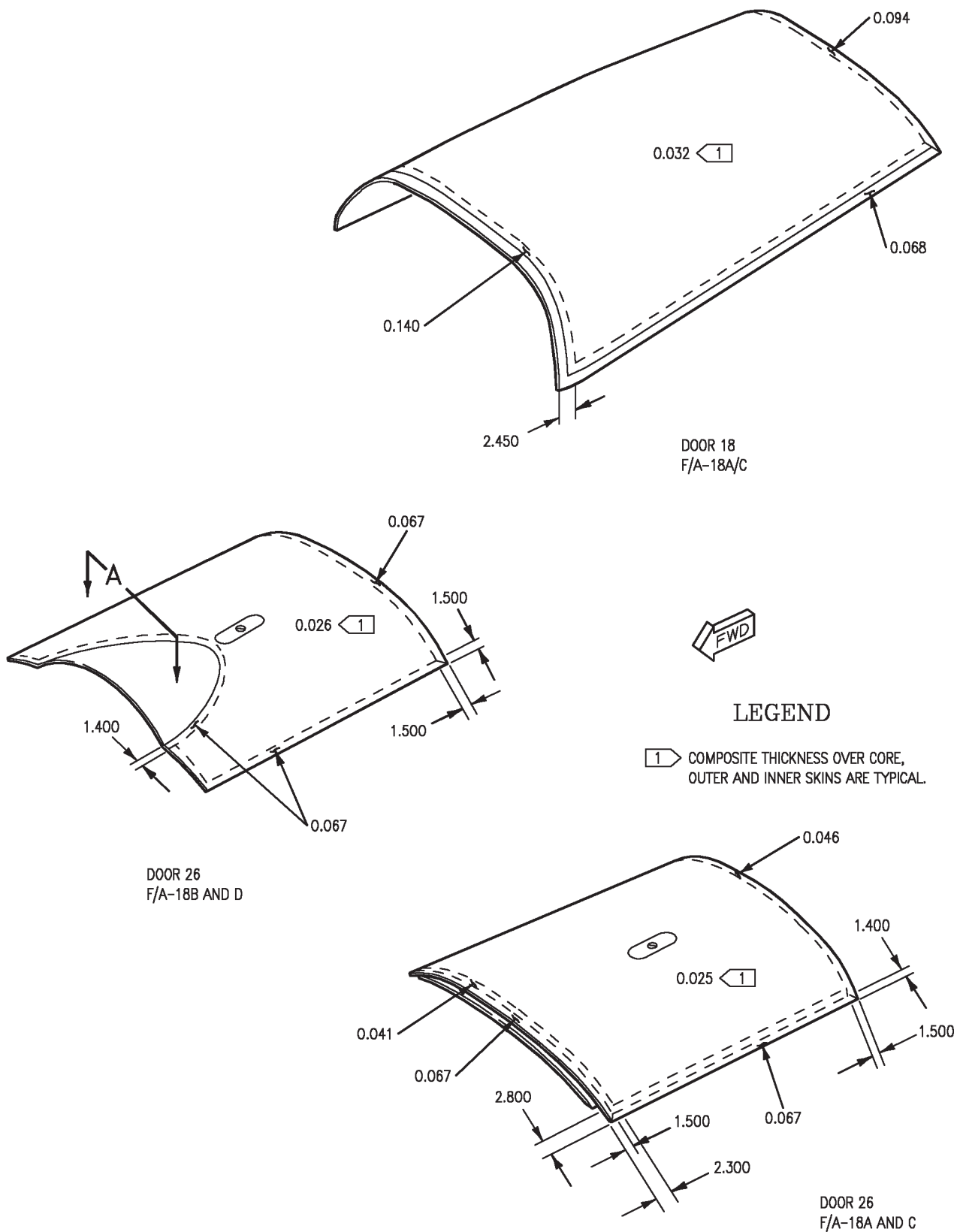


Figure 4. Skin Thicknesses (Sheet 1)

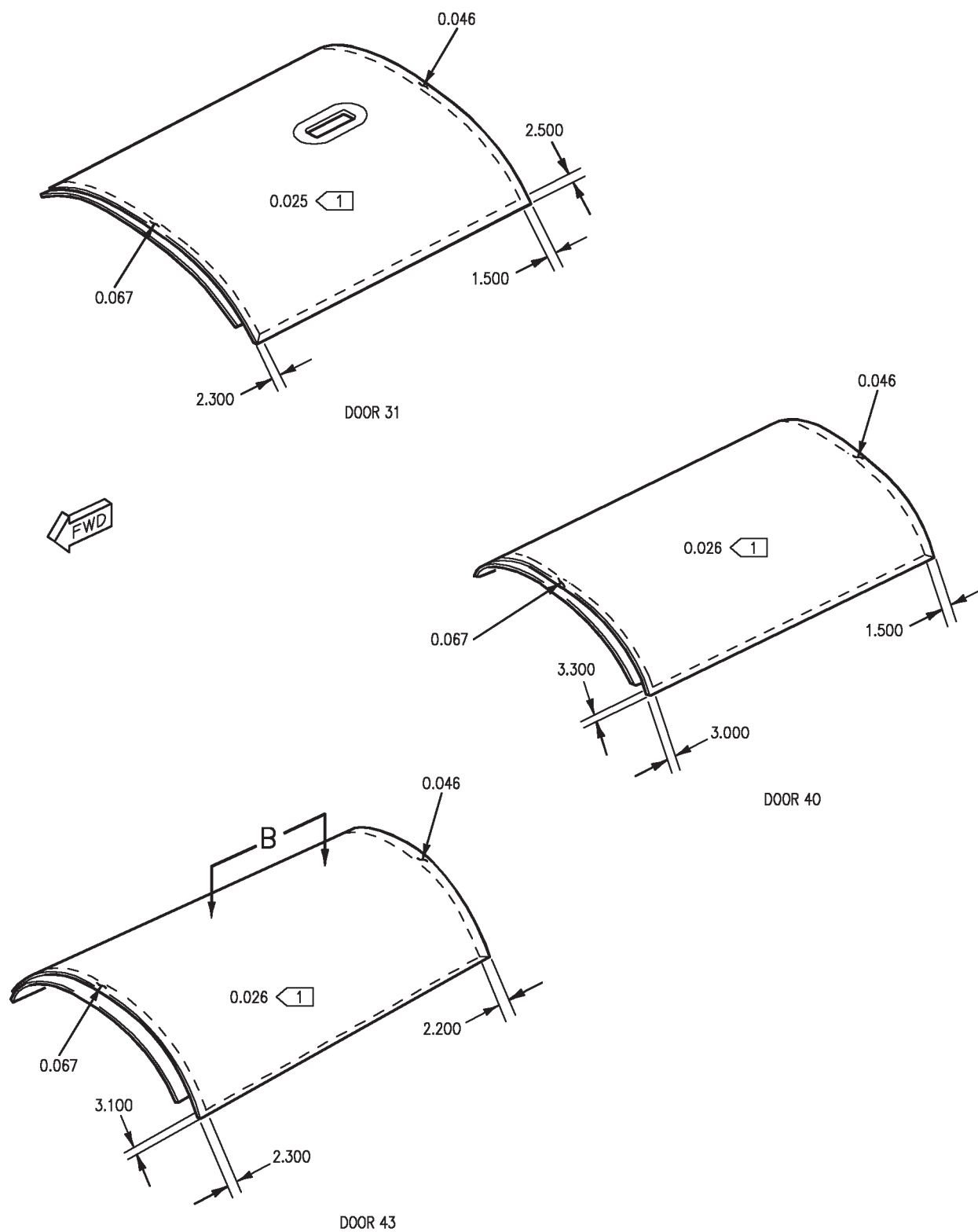


Figure 4. Skin Thickness (Sheet 2)

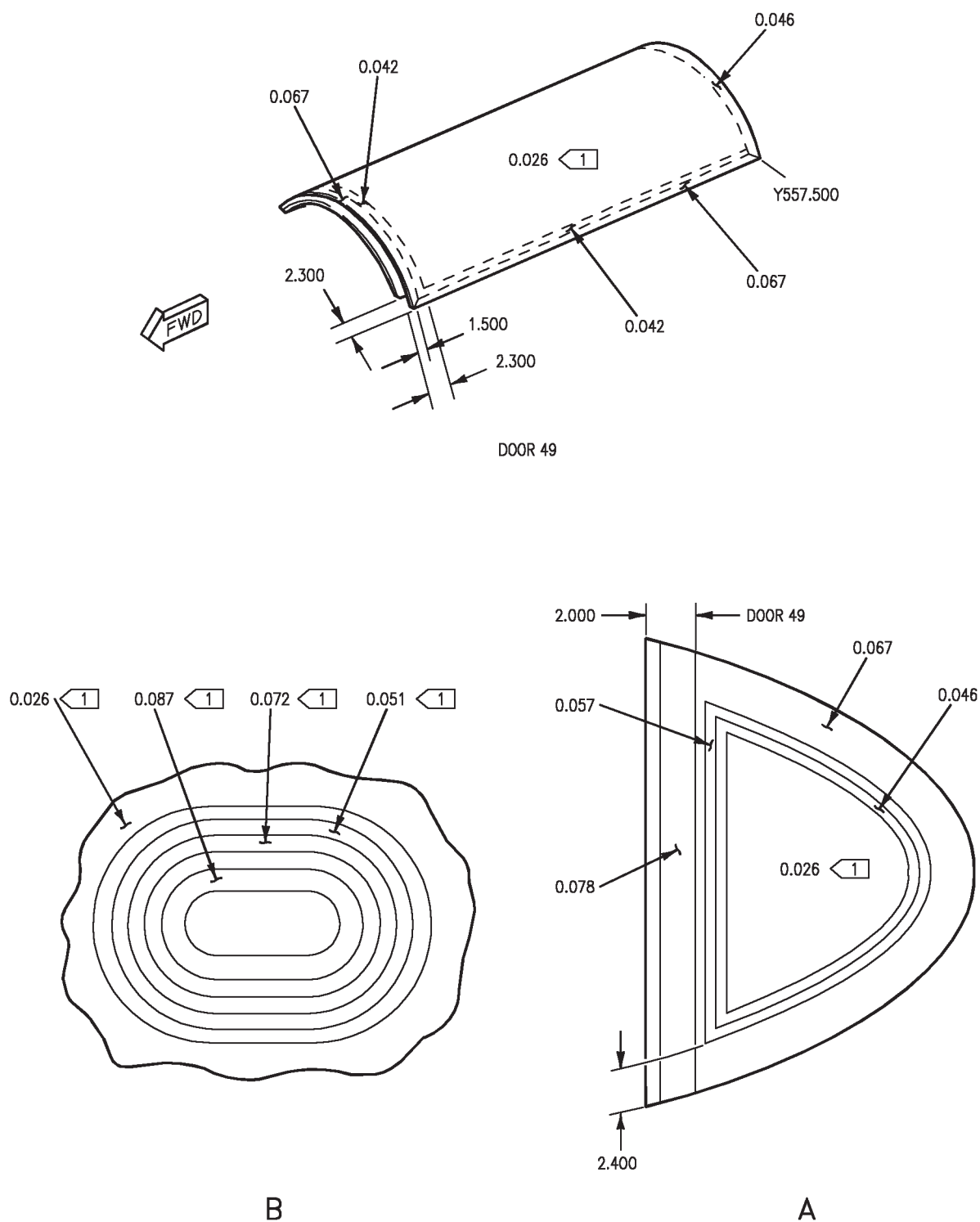


Figure 4. Skin Thickness (Sheet 3)

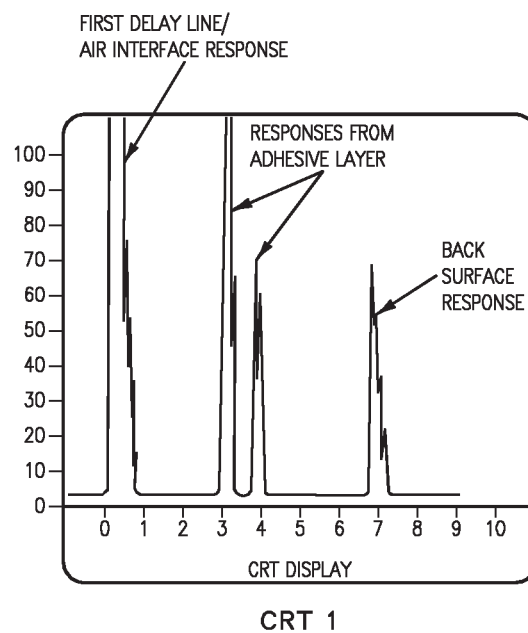
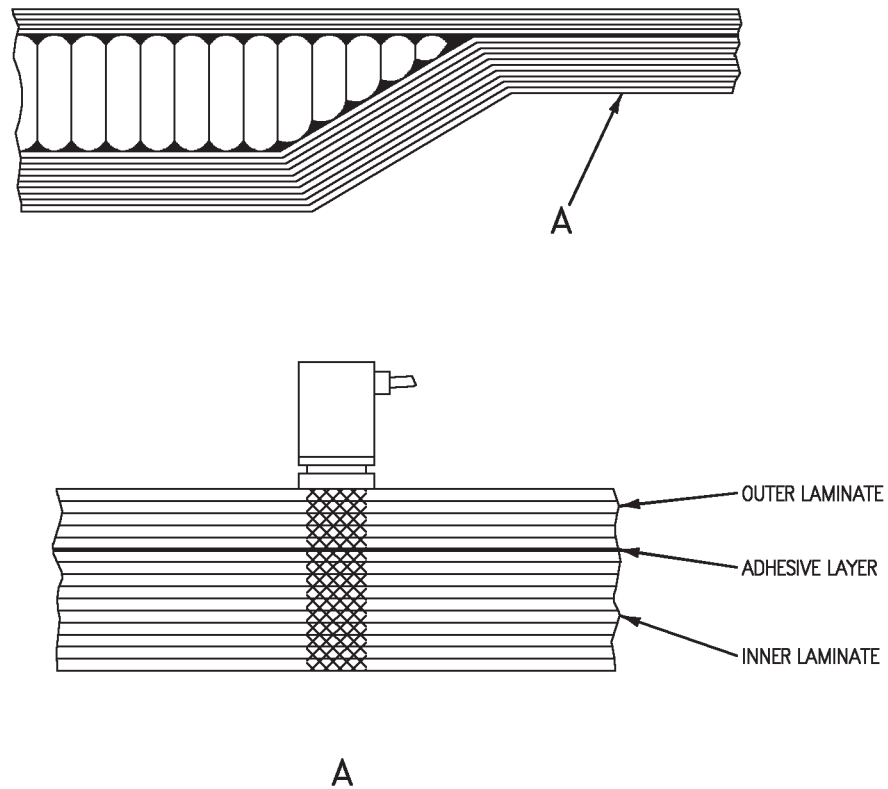


Figure 5. CRT Responses Over Solid Laminate Areas

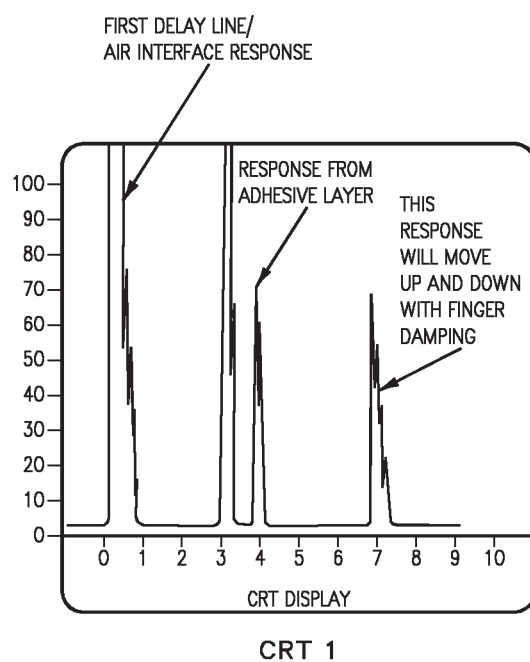
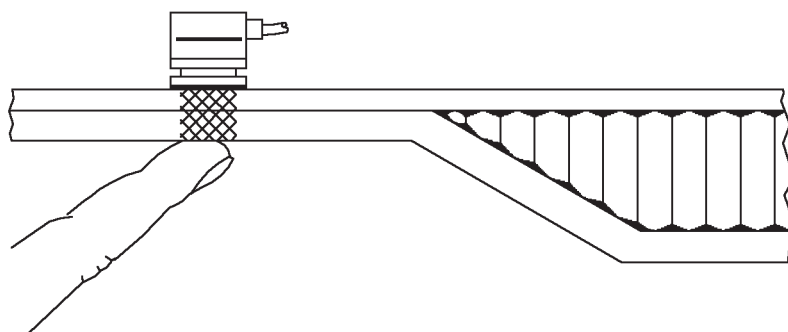
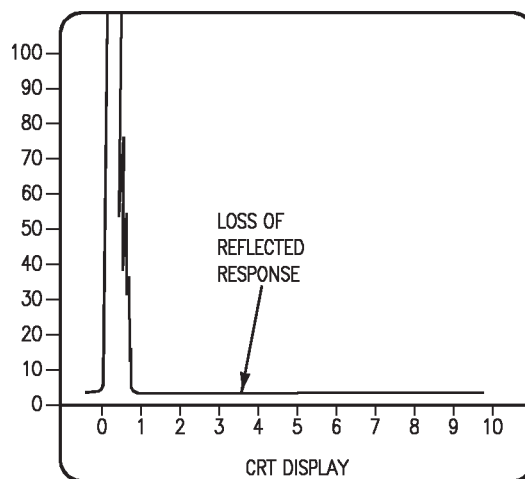
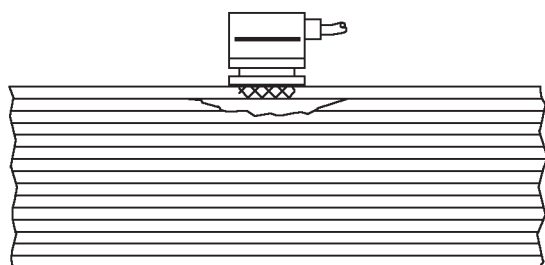
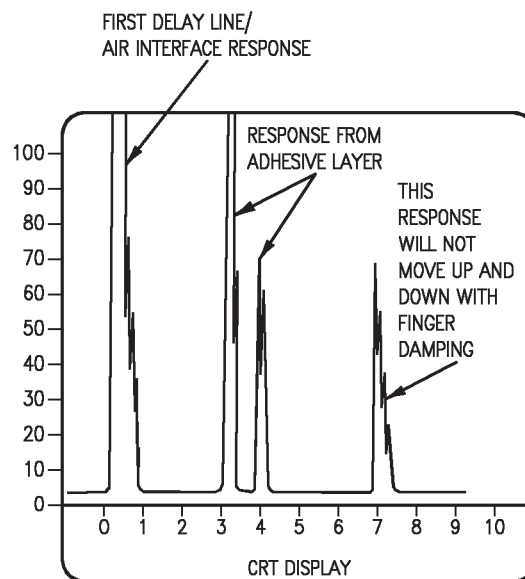
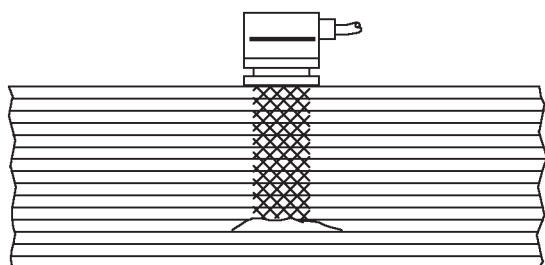


Figure 6. Finger Damping of Back Surface Responses



CRT 1



CRT 2

Figure 7. Delamination Responses



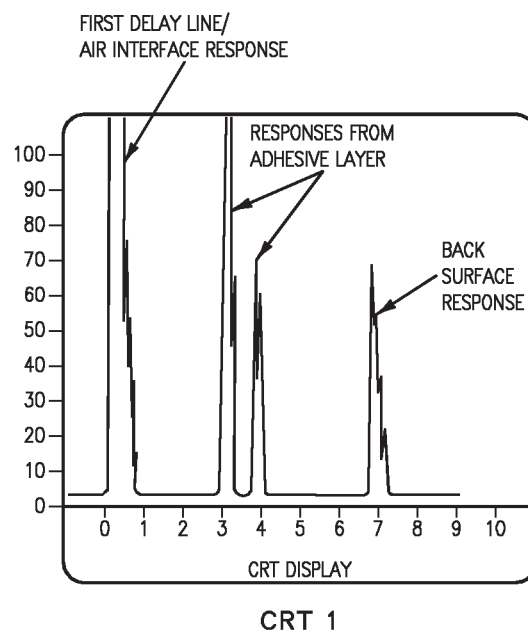
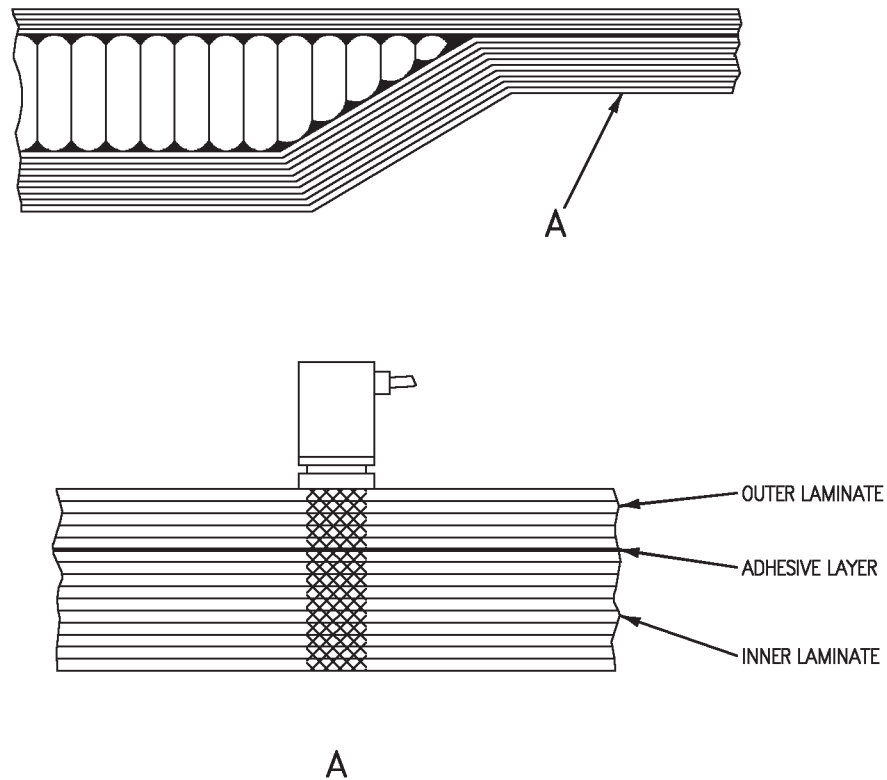


Figure 8. Additional CRT Response from Solid Laminate Areas



## INTERMEDIATE MAINTENANCE

## NONDESTRUCTIVE INSPECTION

## NOSE LANDING GEAR AFT DOOR

## WATER IN HONEYCOMB

## PART NO. 74A460900

## Reference Material

Naval Aviation Maintenance Program .....	OPNAVINST 4790.2
Nondestructive Inspection.....	A1-F18AC-SRM-300
General Information .....	WP003 00
Radiographic Method.....	WP005 00
Nondestructive Inspection Methods .....	NAVAIR 01-1A-16

## Alphabetical Index

Subject	Page No.
Nose Landing Gear Aft Door .....	1
Defects .....	1
Primary Inspection Method .....	1

## Record of Applicable Technical Directives

None

## 1. NOSE LANDING GEAR AFT DOOR.

OPNAVINST 4790.2 SERIES, NDI Technicians,  
NEC 7225/MOS 6044.

2. Nose landing gear aft door, see figure 1, is bonded honeycomb assembly. Honeycomb core is 5056 aluminum alloy flexible core. Skins are graphite epoxy with one ply fiberglass overlay on inner surface. Surface finish is epoxy primer and polyurethane coating.

6. **Preparation of Aircraft.** No special preparation required.

7. **Access.** No special access required.

3. **DEFECTS.** Inspect for water trapped in honeycomb core. Example of defect is contained in WP003 00.

8. **Preparation of Part.** No special preparation required.

4. **PRIMARY INSPECTION METHOD.** Primary inspection method is radiographic.

## Support Equipment Required

5. **Personnel Qualifications.** Personnel doing this nondestructive inspection should be qualified and certified to do radiographic inspections per

Part Number or Type Designation	Nomenclature
314X	Film Identification Set
MIL-STD-453	Penetrameter Set

### Support Equipment Required (Continued)

Part Number or Type Designation	Nomenclature
GXR7-6B	X-ray Apparatus, Portable
072000	X-ray Film Processor

### Materials Required

#### NOTE

Alternate item specifications or part numbers are listed in parentheses.

Specification or Part Number	Nomenclature
INDUSTREX M FILM CODE M2	Radiographic Film, X-ray Film 14x17
INDUSTREXAA FILM CODE AA2 14x17	Radiographic Film, X-ray Film 14x17
MIL-P-83953-2, TYPE 1, CLASS A or B, RED or BLACK	Aircraft Marking Pencil
A-A-883, TYPE 1	Pressure Sensitive Tape, Masking Tape

### WARNING

#### HIGH RADIATION

Make sure applicable safety precautions in WP005 00 and NAVAIR 01-1A-16 are complied with. Failure to comply may result in injury to personnel.

#### 9. Equipment Settings/Standardization/Setup.

Set X-ray unit per data contained in technique chart, see figure 1.

#### 10. Inspection Procedure.

a. Attach identification markers to outer surface of door as shown in figure 1.

b. Attach penetrameters to inner surface of door as shown in figure 1.

c. Locate X-ray source on deck or make sure source window is at least 60 inches from inner surface of door.

#### NOTE

Alternate setup which locates X-ray source at least 60 inches from outer surface of door is allowed. If this alternate is used, reverse inner/outer surface locations of identification markers, penetrameters, and film. Make sure film is in contact with inner surface and AA film is next to inner surface.

d. Make sure X-ray source window is parallel to outer surface of door where film will be located (beam central ray should be perpendicular to plane of film).

#### NOTE

X-ray film for all shots are double loaded. AA film is located next to part and both films are exposed simultaneously.

e. Locate film on outer surface of door for shot 1, see figure 1. Make sure AA film is nearest X-ray source and part.

f. Locate source to aiming point for shot 1. Source should be normal to aiming point and located on inner side of door.

g. Expose film 1 using technique chart settings for shot 1.

h. Remove exposed film.

i. Repeat steps e through g for films 2 and 3, shots 2 and 3.

j. Process exposed film.

k. Interpret radiographs for water in honeycomb (WP005 00).

l. Mark defect(s) using aircraft marking pencil.

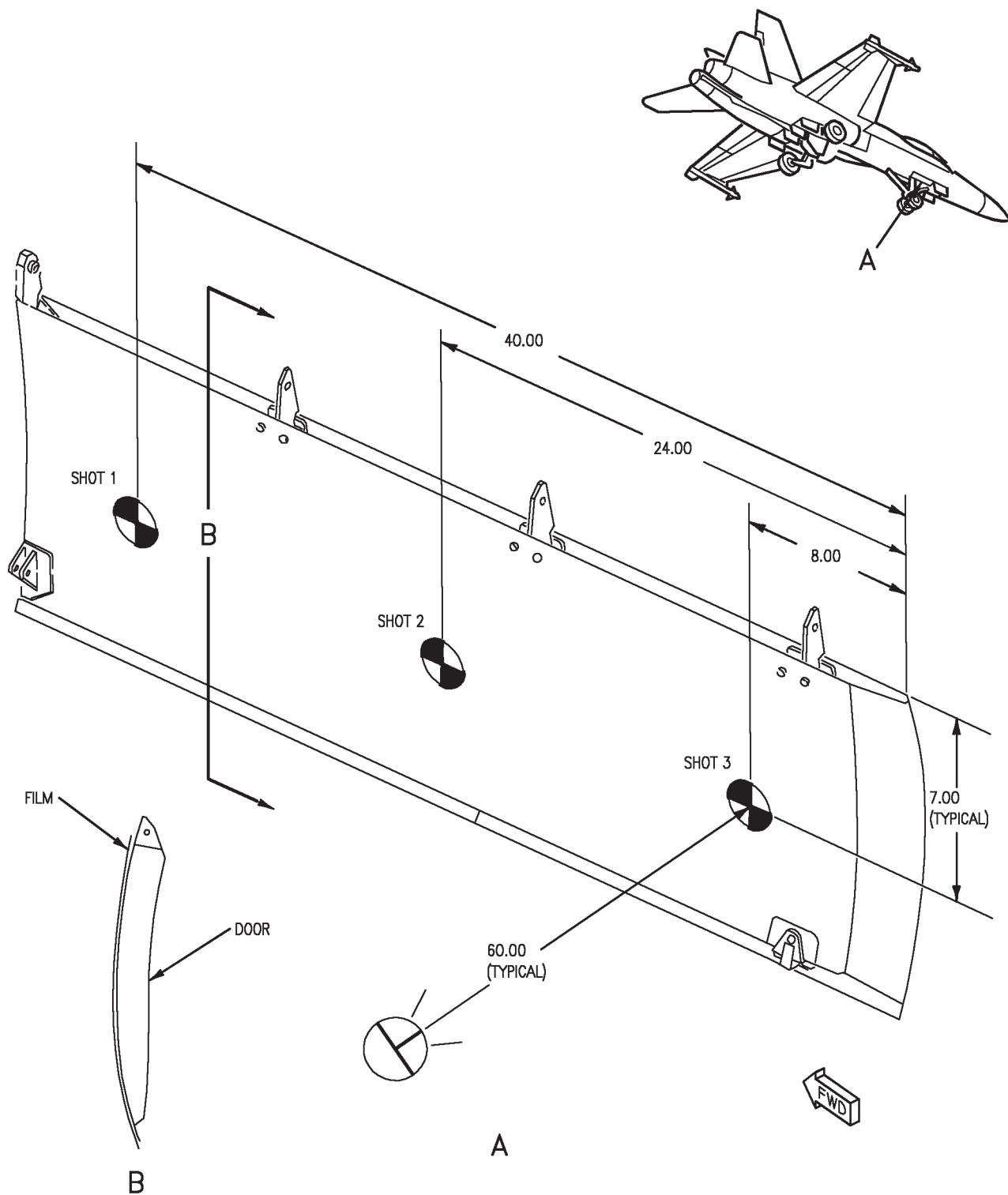
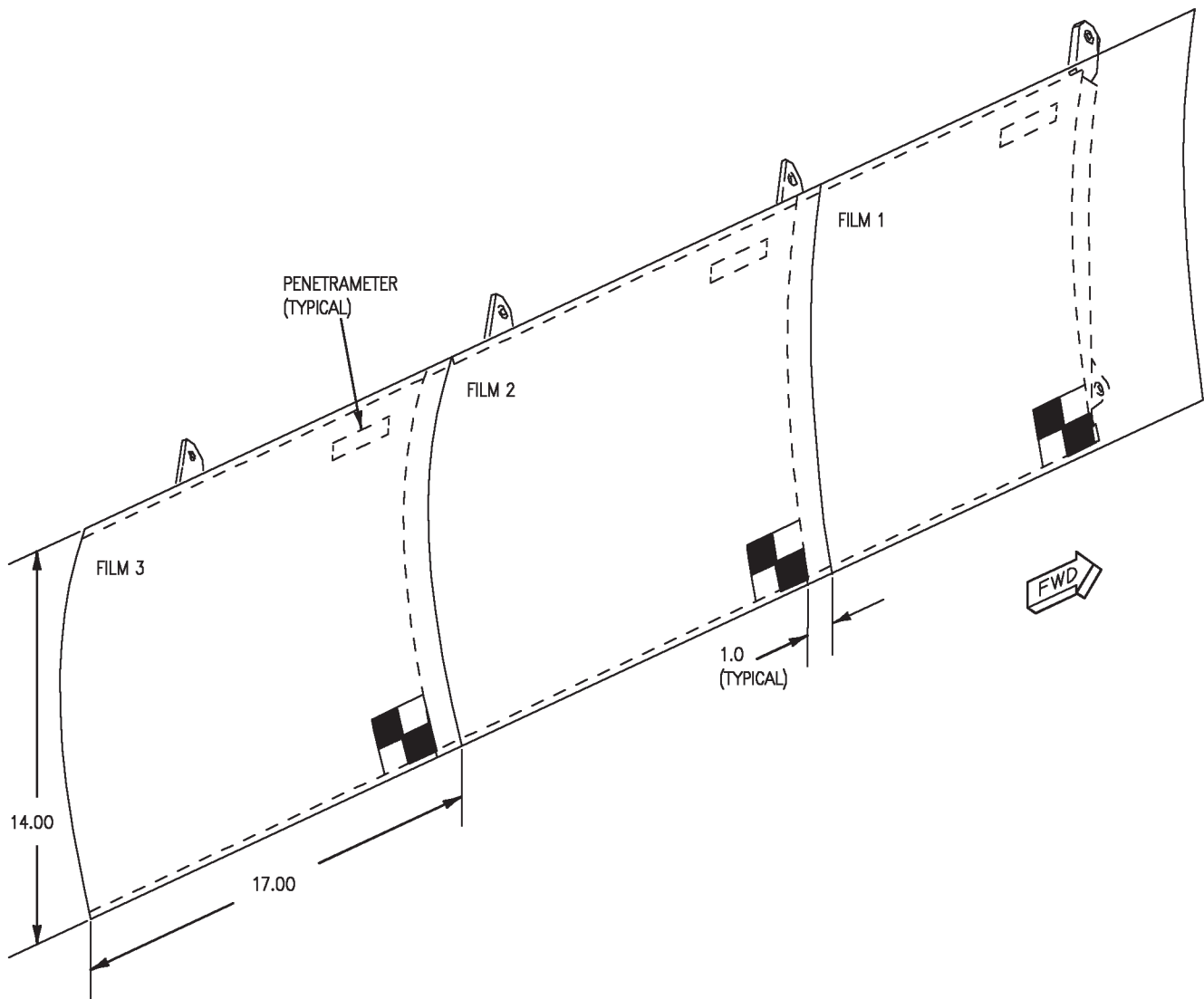


Figure 1. Nose Landing Gear Aft Door, Water in Honeycomb (Sheet 1)





TECHNIQUE CHART								
SHOT	FILM SIZE	FILM GROUP	BACK SCREEN	PENETRATOR MIL-STD-453	mA	kVP	EXPOSURE (MINUTES)	 DENSITY
1	14 X 17	AA AND M	0.0	0.25 AL	5.0	40.0	1	1.0-3.5
2	14 X 17	AA AND M	0.0	0.25 AL	5.0	40.0	1	1.0-3.5
3	14 X 17	AA AND M	0.0	0.25 AL	5.0	40.0	1	1.0-3.5
LEGEND								
 H AND D DENSITY UNITS. 2.0 FILM DENSITY IS PREFERRED.								

Figure 1. Nose Landing Gear Aft Door, Water in Honeycomb (Sheet 2)

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**INTERMEDIATE AND DEPOT MAINTENANCE****NONDESTRUCTIVE INSPECTION****NOSE LANDING GEAR AFT DOOR****SKIN TO CORE UNBONDS AND EDGE DELAMINATIONS****PART NO. 74A460900**

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**Reference Material**

Naval Aviation Maintenance Program .....	OPNAVINST 4790.2
Nondestructive Inspection.....	A1-F18AC-SRM-300
General Information .....	WP003 00
Ultrasonic Through Transmission Contact Testing, Standardization, and Inspection Procedures For Composite Laminate Skins Bonded to Honey- comb Core .....	WP008 01
Pulse-Echo, Longitudinal Wave Contact, With Delay Line, For Composite Laminate Material Bonded to Honeycomb Core .....	WP008 04
Radiographic Method.....	WP005 00
Pulse-Echo, Longitudinal Wave Contact, With Delay Line, For Composite Laminate Material .....	WP008 03
Ultrasonic Through Transmission Contact Testing, Standardization and Inspection Procedures for Composite Laminate and Metallic Skins Bonded to Honeycomb Core .....	WP008 10
Pulse-Echo Longitudinal, Contact, With Delay Line, for Composite Lami- nate Materials.....	WP008 12
Pulse-Echo Longitudinal, Contact, With Delay Line, for Composite Lami- nate Material Bonded to Honeycomb Core .....	WP008 13
Plane Captain Manual .....	A1-F18AC-PCM-000

**Alphabetical Index**

<b>Subject</b>	<b>Page No.</b>
Nose Landing Gear Aft Door .....	2
Defects .....	2
Post Inspection Cleaning and Corrosion Control.....	6
Primary Inspection Method .....	2
Ultrasonic Method Using C-398 Ultrasonic Flaw Detector .....	2
Ultrasonic Method Using MXU-715/E Ultrasonic Flaw Detector .....	3

**Record of Applicable Technical Directives**

None

## 1. NOSE LANDING GEAR AFT DOOR.

2. See figures 1 and 2. Nose landing gear aft door is bonded honeycomb assembly. Honeycomb core is 5056 aluminum alloy flexible core. Closeouts are titanium and graphite epoxy, graphite epoxy with one ply fiberglass overlay on inner surface. Skin to core bonds are made with FM-300 film adhesive. Core to core and closeout to core bonds are made with foaming adhesive. Finish system is epoxy primer and polyurethane coating.

3. **DEFECTS.** Inspect for skin to core unbonds and edge delaminations. Examples of skin to core unbonds and delaminations that may develop in bonded assembly are contained in (WP003 00).

4. **PRIMARY INSPECTION METHOD.** Primary inspection methods are ultrasonic through transmission and pulse-echo.

5. **Personnel Qualifications.** Personnel doing this nondestructive inspection shall be qualified and certified to do ultrasonic inspections per OPNAVINST 4790.2 SERIES, NDI Technicians, NEC 7225/MOS 6044.

6. **Preparation of Aircraft.** No special preparation required.

7. **Access.** No special access required.

## 8. ULTRASONIC METHOD USING C-398 ULTRASONIC TESTER.

## Support Equipment Required

## NOTE

Alternate item type designations or part numbers are listed in parentheses.

Part Number or  
Type Designation

## Nomenclature

C-398 (303B)	Ultrasonic Flaw Detector
57A2271 or EQUIVALENT	Microdot to BNC Connecting Cable, 2 Reqd.

Support Equipment Required  
(Continued)Part Number or  
Type Designation

## Nomenclature

57A2276 or EQUIVALENT	0°, 0.500 Dia., 2.25 MHz Contact Search Unit, 2 Reqd.
GD0504	0°, 0.25 Dia., 5 MHz, Delay Line Contact Search Unit
74D110175-1001	Graphite Epoxy Reference Standard Set Containing the Following:
74D110295-1009	Graphite Epoxy Flat Bottom Hole Reference Standard for Laminates up to 0.450 Inch
74D111295-1005	Honeycomb Reference Standard With Graphite Epoxy Skins for Sandwich Assemblies Less Than 1 Inch

## Materials Required

## NOTE

Alternate item specifications or part numbers are shown indented.

Specification  
or Part Number

## Nomenclature

ULTRAGEL II or EQUIVALENT	Couplant
MIL-P-83993-2, TYPE 1, CLASS A or B, RED or BLACK	Aircraft Marking Pencil
P-D-680 TYPE 2 D 1153	Dry Cleaning Solvent Methyl Isobutyl Ketone
CCC-C-46, TYPE 1, CLASS 4	Cleaning Cloth



**WARNING**

Dry cleaning solvent and methyl Isobutyl ketone are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

9. **Preparation of Part.** Clean inner and outer surfaces of inspection area with solvent moistened cloth to make sure part is free of contamination or foreign material.

**WARNING**

Make sure safety precautions have been met for electrical, static, grounding when using ultrasonic equipment near aircraft fuel cells, oxygen systems, electronic systems, and stores (A1-F18AC-PCM-000).

10. **Equipment Settings/Standardization Setup for Skin to Core Areas.** See figure 3. Do standardization per (WP008 01), and as below:

- a. Use two 57A2276 search units.
- b. Use P-1 calibration point on 74D111295-1005 graphite/epoxy skinned honeycomb core sandwich assembly reference standard.

11. **Inspection Procedure for Skin to Core and Thick Laminate Areas.** See figure 4 and 5. After standardization, inspect skin to core area of door per (WP008 01), except as below:

- a. Use two 57A2276 search units.
- b. Apply couplant to both surfaces of inspection area(s).
- c. Make sure initial pulse width does not interfere with location of received response. If required, switch position of search units on microdot cables or use different search unit on receiver cable.
- d. Use ultrasonic pulse-echo per (WP008 04) to determine if suspect areas are result of skin delaminations. Do pulse-echo inspection on both

surfaces to help identify location of flaws causing through transmission unbond response.

**WARNING**

12. **Equipment/Standardization/Setup for Composite Laminate and Skin to Closure Area.**

Do standardization for thin laminates and skin to closure areas per (WP008 03), making sure trailing edge of initial pulse is located at less than 1 large division when 0.100 inch FBH response is 80 to 90 percent CRT height.

13. **Inspection Procedure for Composite Laminate and Skin to Closure Areas.** Inspect thin laminate and skin to closure areas per (WP008 03) and following:

- a. Apply couplant to solid laminate inspection area where laminate thickness is known.
- b. Make sure leading edge of back surface response is located at correct location on horizontal baseline when peak amplitude is 80 to 90 percent CRT height.
- c. Scan area to be inspected, finger damping back surface response often as required to make sure correct response is being received. Finger damp by placing couplant on end of finger and touching opposite surface. As finger touches and is then removed from part surface, reflected response on CRT will move up and down as it is damped, indicating good bond.
- d. For inspection responses in addition to those described in (WP008 03), refer to figure 6.
- e. Use pulse-echo mapping techniques per (WP008 03) to determine extent of flaw indication.
- f. Do paragraph 20.

#### 14. ULTRASONIC METHOD USING MXU-715/E ULTRASONIC FLAW DETECTOR.

##### Support Equipment Required

Part Number or Type Designation	Nomenclature
1642AS100-1	Ultrasonic Flaw Detector, MXU-715/E, Magnaflux
57A2271 or EQUIVALENT	Microdot to BNC Connecting Cable, 2 Req'd.
57A2276 or EQUIVALENT	0°, 0.500 Dia., 2.25 MHz Contact Search Unit ,2 Req'd.
GD0504	0°, 0.25 Dia., 5 MHz, Delay Line Contact Search Unit
74D110175-1001	Graphite Epoxy Refer- ence Standard Set Containing the Following:
74D110295-1009	Graphite Epoxy Flat Bottom Hole Reference Standard for Laminates up to 0.450 Inch
74D111295-1005	Honeycomb Reference Standard With Graphite Epoxy Skins for Sandwich Assemblies Less Than 1 Inch

##### Materials Required

###### NOTE

Alternate item specifications or part numbers are shown indented.

Specification or Part Number	Nomenclature
ULTRAGEL II or EQUIVALENT	Couplant
MIL-P-83993-2, TYPE 1, CLASS A or B, RED or BLACK	Aircraft Marking Pencil

##### Materials Required (Continued)

###### NOTE

Alternate item specifications or part numbers are shown indented.

Specification or Part Number	Nomenclature
P-D-680 TYPE 2 D 1153	Dry Cleaning Solvent Methyl Isobutyl Ketone
CCC-C-46, TYPE 1, CLASS 4	Cleaning Cloth

###### WARNING

Dry cleaning solvent and methyl Isobutyl ketone are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

15. **Preparation of Part.** Clean inner and outer surfaces of inspection area with solvent moistened cloth to make sure part is free of contamination or foreign material.

###### WARNING

Make sure safety precautions have been met for electrical, static, grounding when using ultrasonic equipment near aircraft fuel cells, oxygen systems, electronic systems, and stores (A1-F18AC-PCM-000).

16. **Equipment Settings/Standardization Setup for Skin to Core Areas.** See figure 3. Do standardization per (WP008 10), and as below:

- Use two 57A2276 search units.
- Use P-1 calibration point on 74D111295-1005 graphite/epoxy skinned honeycomb core sandwich assembly reference standard.

17. **Inspection Procedure for Skin to Core and Thick Laminate Areas.** See figures 4 and 5. After standardization, inspect skin to core area of door per (WP008 10),

except as below:

Use two 57A2276 search units.

a. Apply couplant to both surfaces of inspection area(s).

b. Make sure initial pulse width does not interfere with location of received response. If required, switch position of search units on microdot cables or use different search unit on receiver cable.

c. Use ultrasonic pulse-echo per (WP008 13) to determine if suspect areas are result of skin delaminations. Do pulse-echo inspection on both surfaces to help identify location of flaws causing through transmission unbond response.

## WARNING

### 18. Equipment/Standardization/Setup for Composite Laminate and Skin to Closure Area.

Do standardization for thin laminates and skin to closure areas per (WP008 12), making sure trailing edge of initial pulse is located at less than 1 large division when 0.100 inch FBH response is 80 to 90 percent CRT height.

19. **Inspection Procedure for Composite Laminate and Skin to Closure Areas.** Inspect thin laminate and skin to closure areas per (WP008 12) and following:

a. Apply couplant to solid laminate inspection area where laminate thickness is known.

b. Make sure leading edge of back surface response is located at correct location on horizontal baseline when peak amplitude is 80 to 90 percent CRT height.

c. Scan area to be inspected, finger damping back surface response often as required to make sure correct response is being received. Finger damp by placing couplant on end of finger and touching opposite surface. As finger touches and is then removed from part surface, reflected response on CRT will move up and down as it is damped, indicating good bond.

d. For inspection responses in addition to those described in (WP008 12), refer to figure 6.

e. Use pulse-echo mapping techniques per (WP008 12) to determine extent of flaw indication.

## WARNING

Dry cleaning solvent and methyl Isobutyl ketone are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

20. **POST INSPECTION CLEANING AND CORROSION CONTROL.** After recording any defects, clean inspection marks and couplant from doors with solvent moistened cloth.



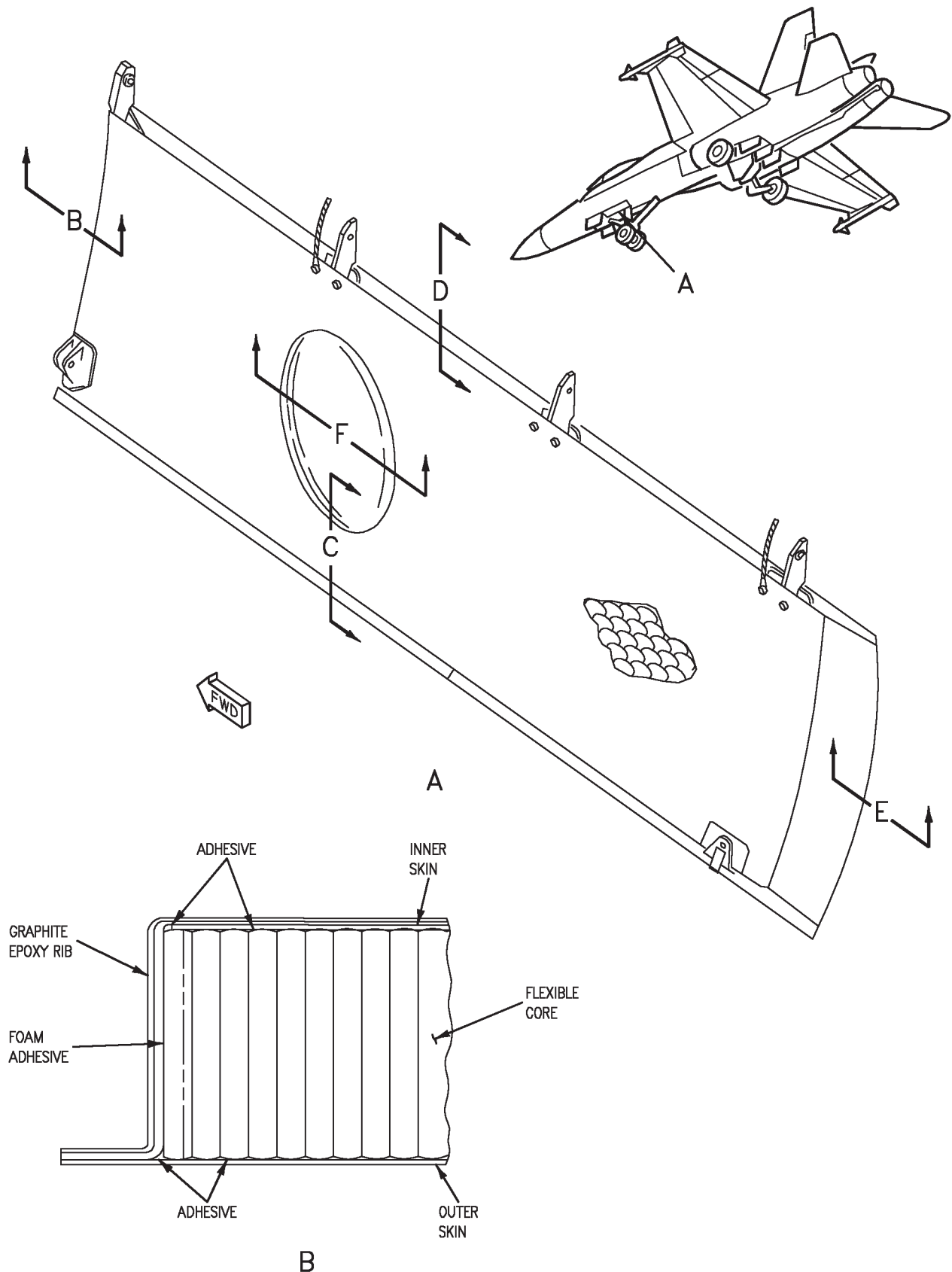


Figure 1. Structure and Core Thickness (Sheet 1)

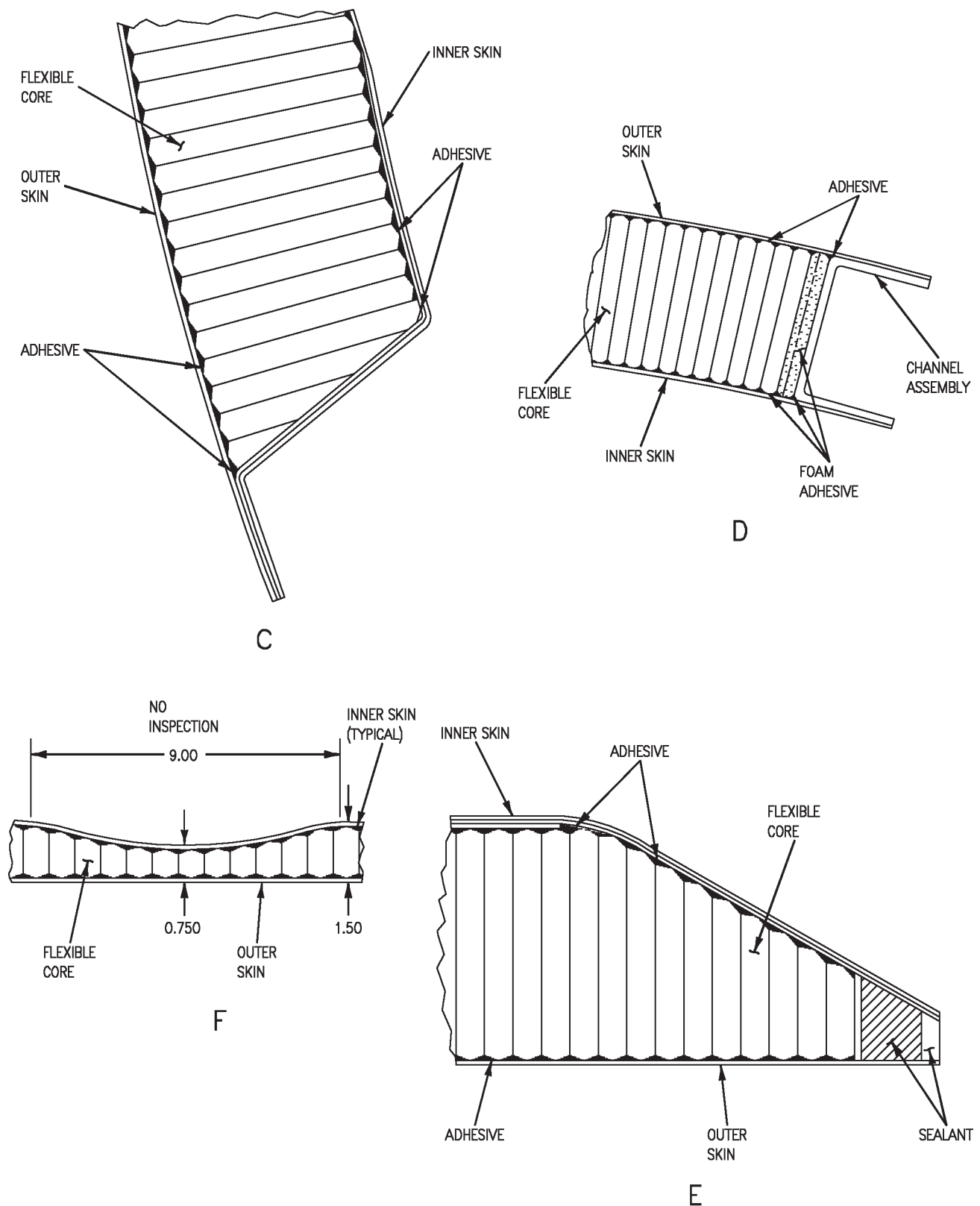


Figure 1. Structure and Core Thickness (Sheet 2)

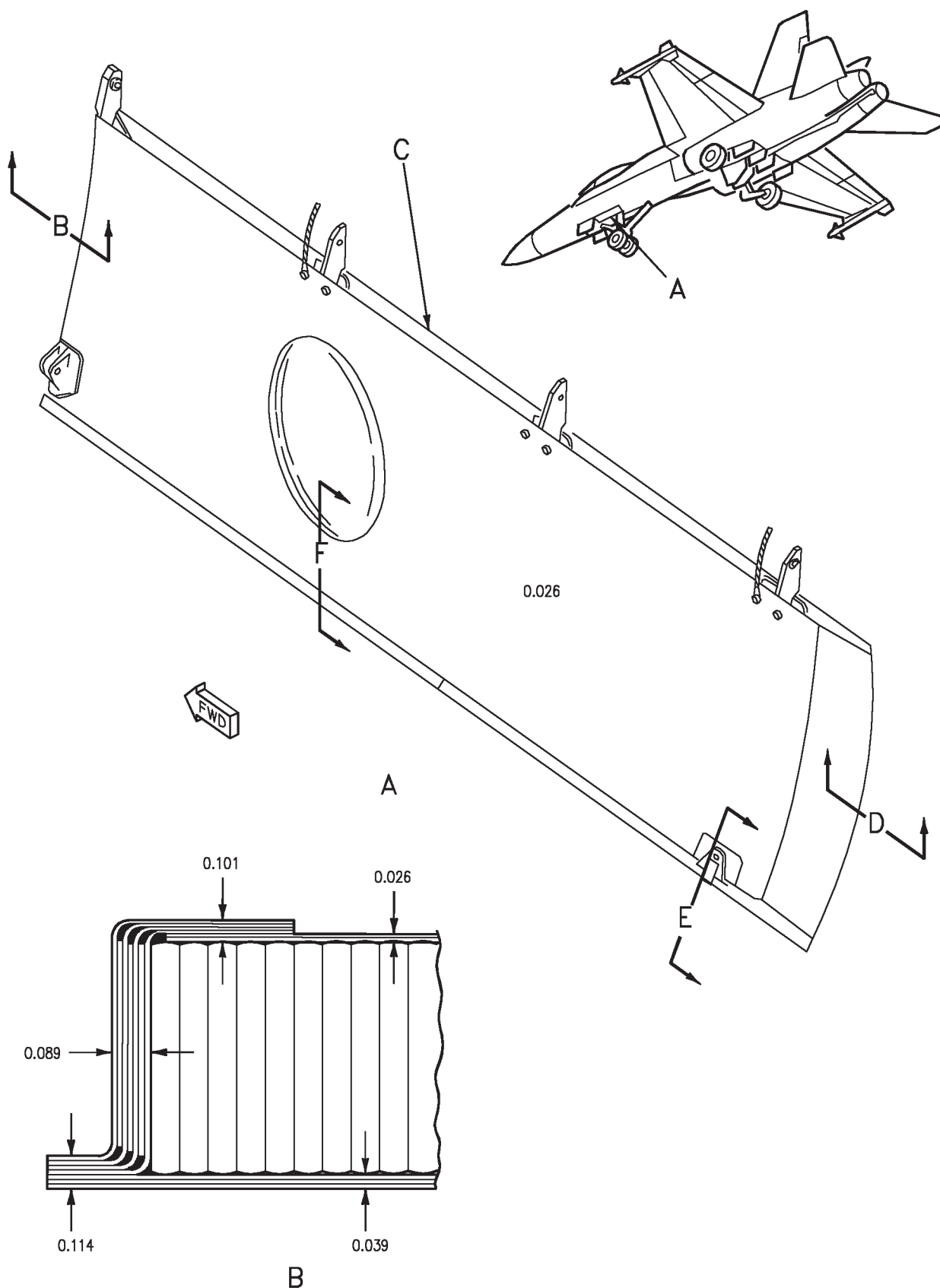


Figure 2. Skin Thickness (Sheet 1)

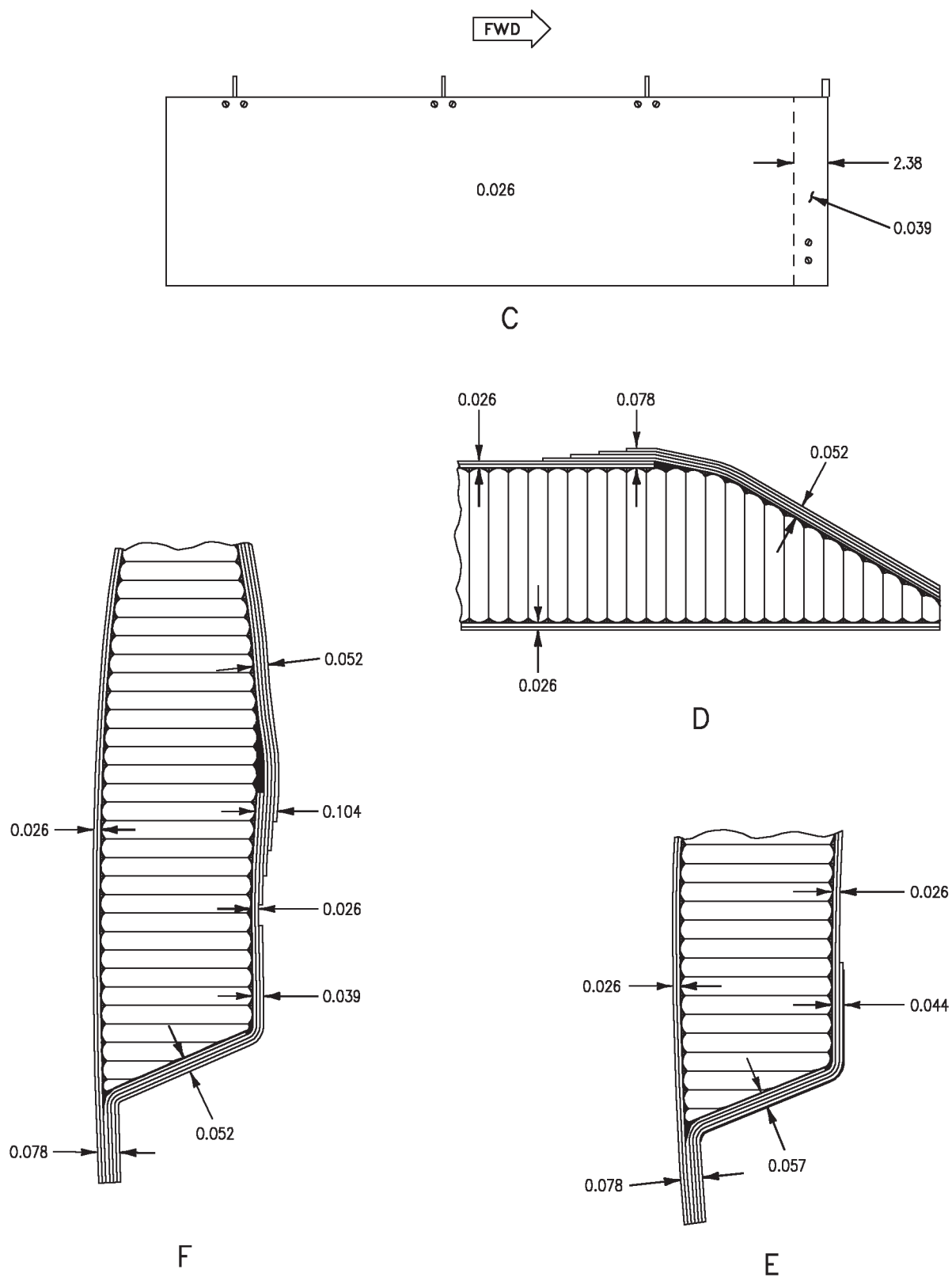
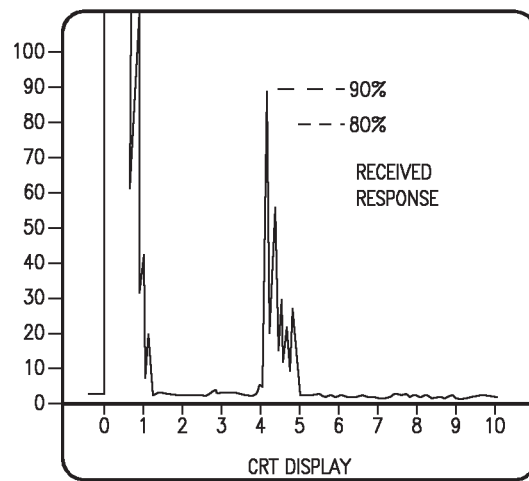
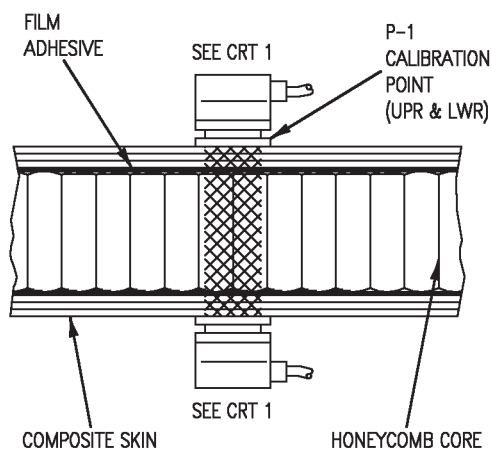


Figure 2. Skin Thickness (Sheet 2)

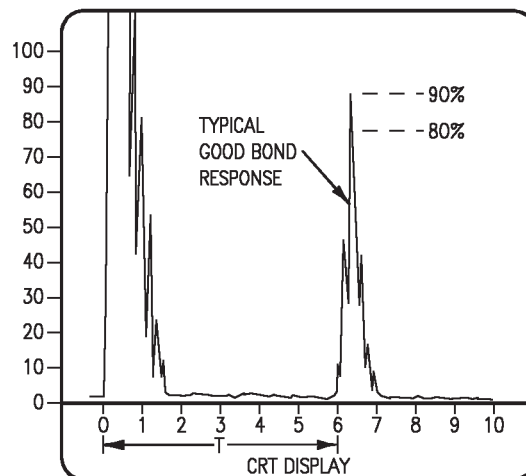
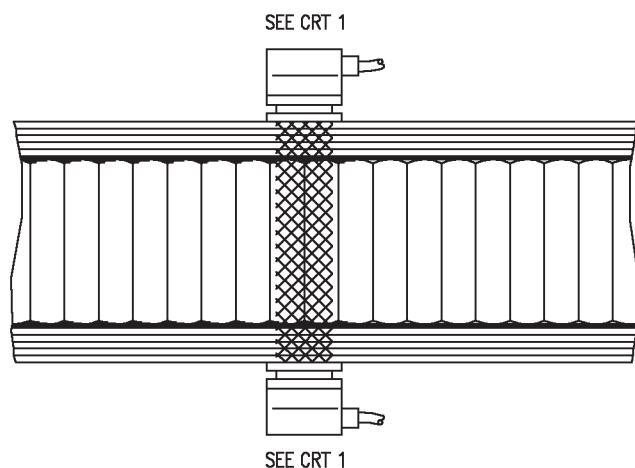




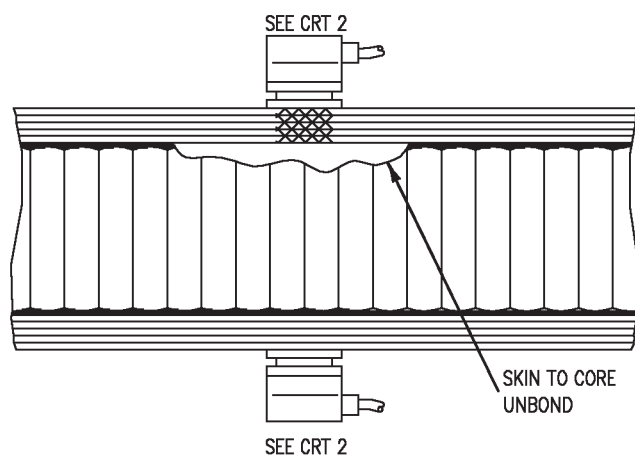
CRT 1

LEADING EDGE OF RECEIVED RESPONSE  
LOCATED AT 4 ON THE HORIZONTAL BASELINE.

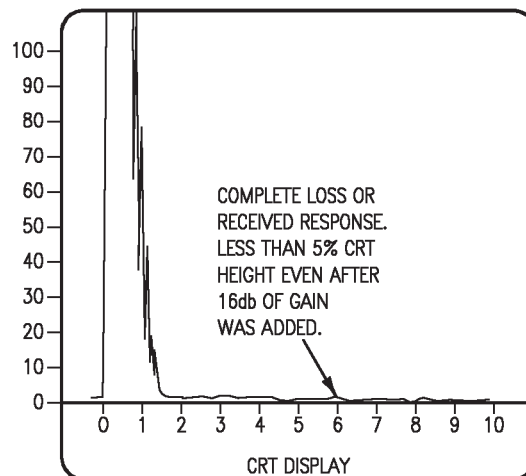
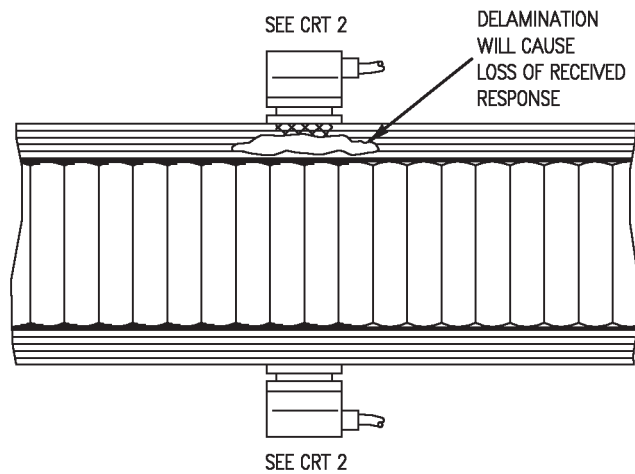
**Figure 3. Standardization on One Inch Tall  
Graphite Epoxy Skinned Honeycomb Core Sandwich Assembly Reference Standard**



CRT 1

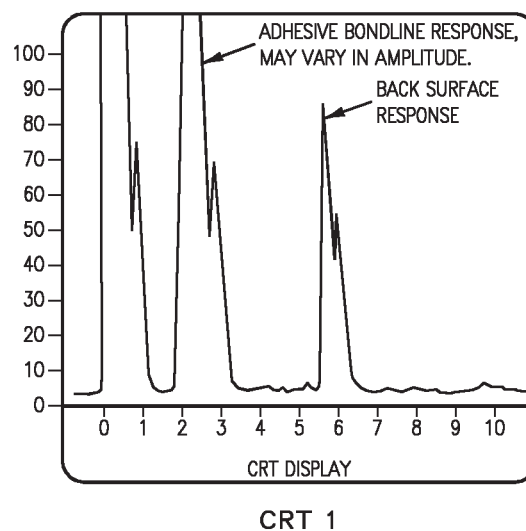
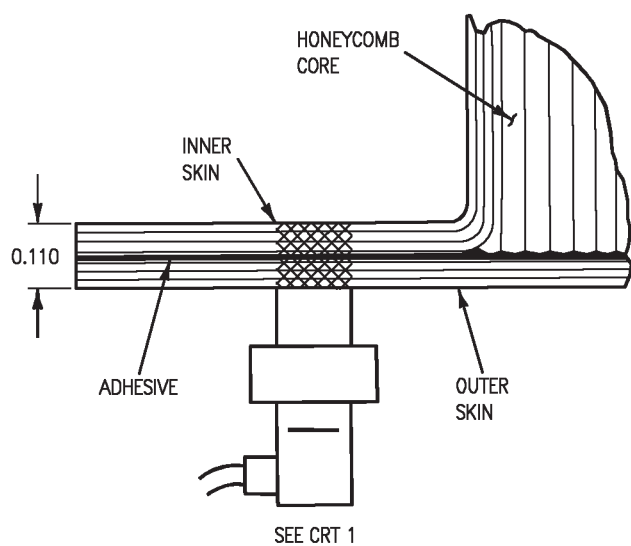
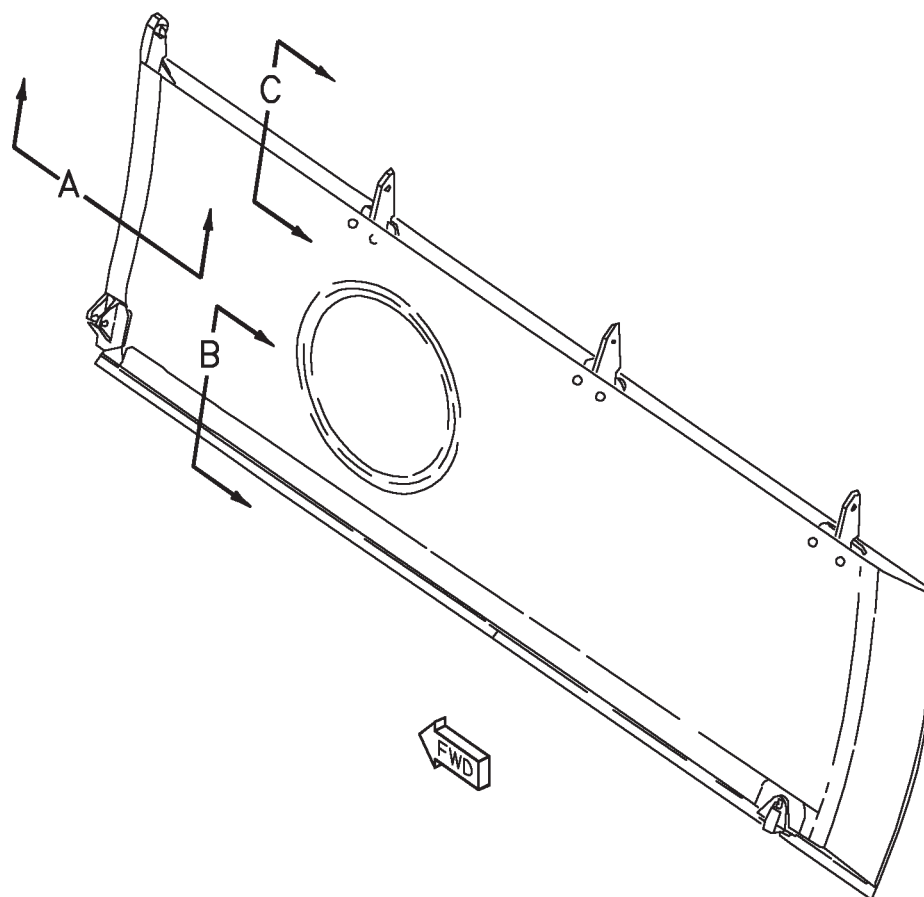


OR



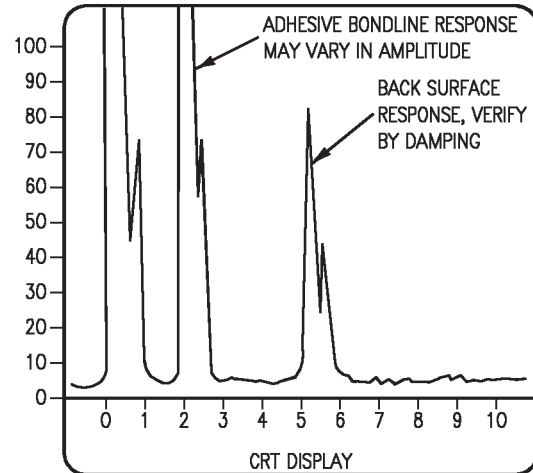
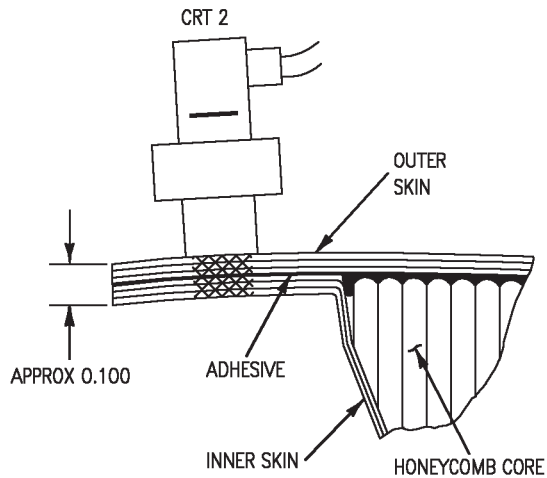
CRT 2

Figure 4. Nose Landing Gear Aft Door Honeycomb Core Inspection Responses



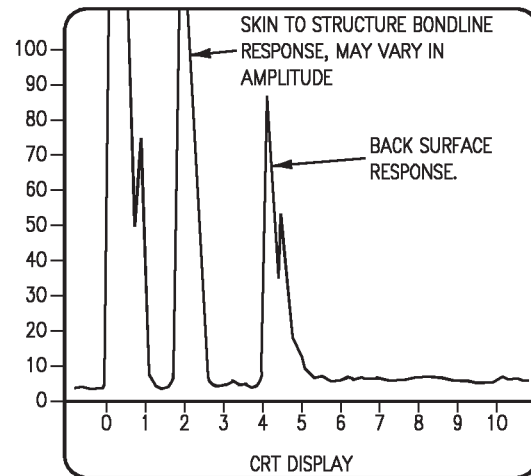
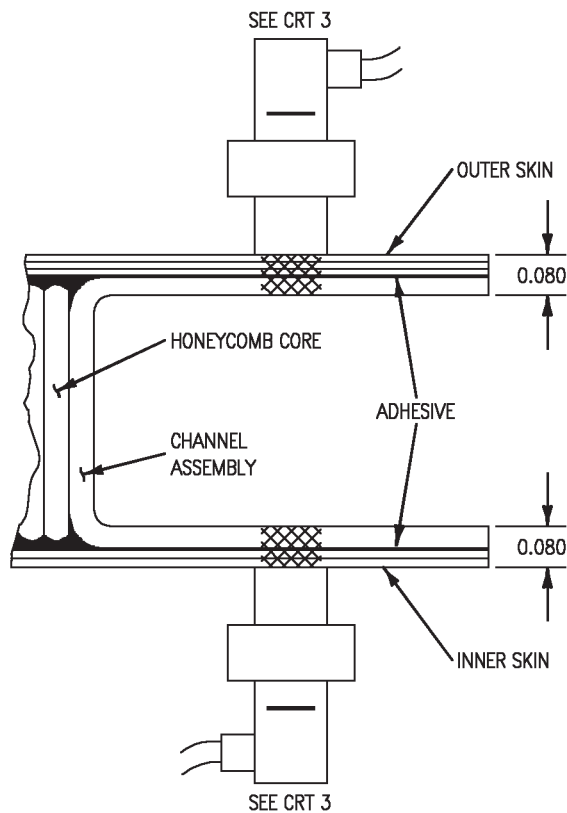
A

Figure 5. Nose Landing Gear Aft Door Inspection Responses (Sheet 1)



CRT 2

B



CRT 3

C

Figure 5. Nose Landing Gear Aft Door Inspection Responses (Sheet 2)

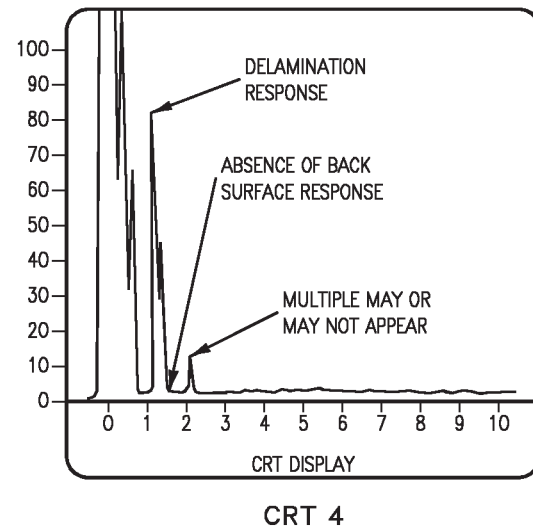
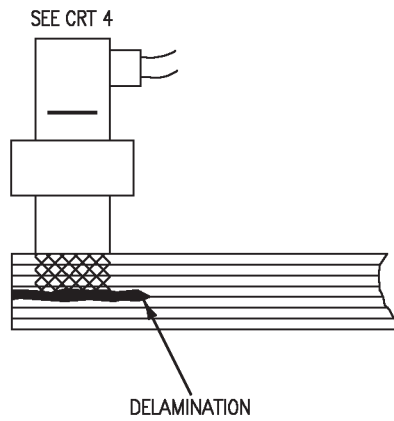
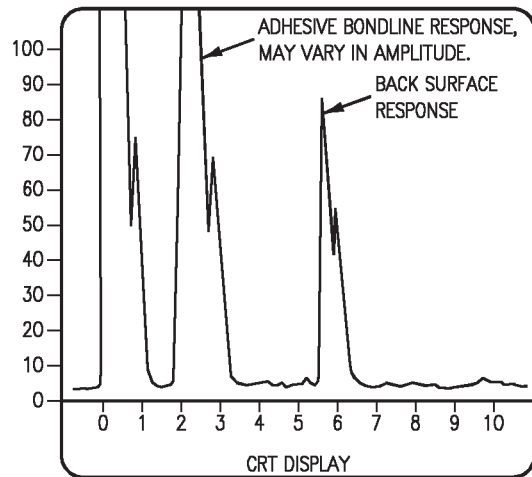
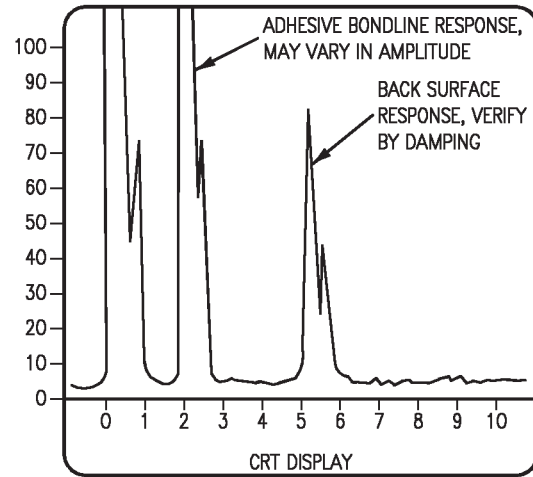


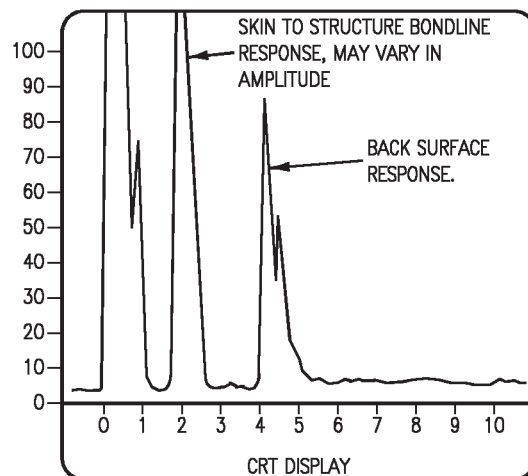
Figure 5. Nose Landing Gear Aft Door Inspection Responses (Sheet 3)



CRT 1



CRT 2



CRT 3

Figure 6. Inspection Responses

## INTERMEDIATE MAINTENANCE

## NONDESTRUCTIVE INSPECTION

## ULTRASONIC METHOD

## VERTICAL STABILIZER LEADING EDGE

SKIN TO CORE UNBONDS, SKIN DELAMINATIONS, AND TITANIUM SKIN TO COMPOSITE  
SKIN UNBONDS

PART NO. 74A230780

## Reference Material

Naval Aviation Maintenance Program .....	OPNAVINST 4790.2
Plane Captain Manual .....	A1-F18AC-PCM-000
Nondestructive Inspection .....	A1-F18AC-SRM-300
Ultrasonic Through Transmission Contact Testing, Standardization, and Inspection Procedures For Composite Laminate Skins Bonded to Honey- comb Core .....	WP008 01
Pulse-Echo, Longitudinal Wave Contact, With Delay Line, For Composite Laminate Material Bonded to Honeycomb Core .....	WP008 04
Ultrasonic Resonance Inspection With Fokker Bond Tester .....	WP008 06
Pulse-Echo, Longitudinal Wave Contact, With Delay Line, For Composite Laminate Material .....	WP008 03
Ultrasonic Through Transmission Contact Testing, Standardization and Inspection Procedures for Composite Laminate and Metallic Skins Bonded to Honeycomb Core .....	WP008 10
Pulse-Echo Longitudinal, Contact, With Delay Line, for Composite Laminate Materials .....	WP008 12
Pulse-Echo Longitudinal, Contact, With Delay Line, for Composite Laminate Material Bonded to Honeycomb Core .....	WP008 13

## Alphabetical Index

Subject	Page No.
Vertical Stabilizer Leading Edge .....	2
Defects .....	2
Post Inspection Cleaning and Corrosion Control .....	8
Primary Inspection Method .....	2
Ultrasonic Method Using C-398 Ultrasonic Flaw Detector .....	2
Ultrasonic Method Using MXU-715/E Ultrasonic Flaw Detector .....	5

## Record of Applicable Technical Directives

None

## 1. VERTICAL STABILIZER LEADING EDGE.

2. Vertical stabilizer leading edge, see figure 1, is bonded honeycomb assembly. Honeycomb core is 0.188 hexagonal cell, 5056 aluminum alloy. Structure enclosing core is graphite epoxy and titanium. Skins are graphite/epoxy laminate with 0.012 inch thick titanium bonded to leading edge. Skin to core, skin to structure, and skin to 0.012 inch titanium sheet bonds are made with FM-300 film adhesive. Core to core and closeout to core bonds are made with foaming adhesive. Surface finish is epoxy primer and polyurethane coatings.

3. **DEFECTS.** Inspect for skin to core unbonds, skin delaminations, and titanium skin to composite skin unbonds.

4. **PRIMARY INSPECTION METHOD.** Primary inspection methods are ultrasonic through transmission, ultrasonic pulse-echo, and ultrasonic resonance.

5. **Personnel Qualifications.** Personnel doing this nondestructive inspection shall be qualified and certified to do ultrasonic inspections per OPNAVINST 4790.2 SERIES, NDI Technicians, NEC 7225/MOS 6044.

6. **Preparation of Aircraft.** No special preparation required.

7. **Access.** No special access required.

8. ULTRASONIC METHOD USING C-398  
ULTRASONIC FLAW DETECTOR.

## Support Equipment Required

Part Number or Type Designation	Nomenclature
C-398	Ultrasonic Flaw Detector
57A2271 or EQUIVALENT	Microdot to BNC Connecting Cable, 2 Req'd.
57A2276 or EQUIVALENT	0°, 0.500 Dia., 2.25 MHz, Contact, Delay Line, Search Unit, 2 Req'd.

Support Equipment Required  
(Continued)

Part Number or Type Designation	Nomenclature
GD0504	0°, 0.25 inch Dia., 5 MHz, Contact, Delay Line, Search Unit
74D110175-1001	Graphite Epoxy Reference Standard Set Containing the Following:
74D111295-1009	Graphite Epoxy Flat Bottom Hole Reference Standard for Laminates up to 0.450 Inch
74D111295-1005	Honeycomb Reference Standard With Graphite Epoxy Skins for Sandwich Assemblies Less Than 1 Inch
74D111295-1003	Honeycomb Reference Standard With Graphite Epoxy Skins for Sandwich Assemblies 1 to 2 Inches
74D111295-1001	Honeycomb Reference Standard With Graphite Epoxy Skins for Sandwich Assemblies 2 Inches or Taller
Model 80 3814	Fokker Bond Tester
Yellow Bond Tester Adapter	Fokker Probe Probe Adapter Assembly



**Materials Required****NOTE**

Alternate item part numbers are shown indented.

**Specification  
or Part Number****Nomenclature**

ULTRAGEL II or  
EQUIVALENT  
M83953-1 or -2

Ultrasonic Couplant

PD680TY2  
D 1153

Pencil, Aircraft  
Marking  
Dry Cleaning Solvent  
Methyl Isobutyl  
Ketone

CCCC46TYICL4  
MIL-I-25135

Cloth, Cleaning  
Penetrant Emulsifier

**WARNING**

Dry cleaning solvent and methyl isobutyl ketone are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

**9. Preparation of Part.**

a. Clean inspection area(s) of contamination or foreign material using water or, if required, cleaning cloth moistened with dry cleaning solvent or methyl isobutyl ketone.

b. On stabilizer leading edge surface; locate, mark, and identify inspection areas, core splice lines, and boundaries, shown in figures 1 and 2.

**WARNING**

Make sure safety precautions have been met for electric, static grounding when using ultrasonic equipment near aircraft fuel cells, oxygen systems, electronic systems, and stores (A1-F18AC-PCM-000).

10. **Standardization for Inspection of Skin to Core Areas.** See figures 3, 4, and 5. For all thicknesses of core, do standardization (WP008 01), and as below:

a. Use two 57A2276 search units.

b. Use P-1 calibration point on applicable 74D111295 graphite epoxy skinned honeycomb core sandwich assembly reference standard, see figure 2 for core thicknesses.

11. **Inspection Procedure for Skin to Core Areas.** See figures 6, 7, and 8. After standardization, inspect skin to core area of door per (WP008 01), except as specified below:

a. Use two 57A2276 search units.

**WARNING**

Couplant may cause eye irritation. Avoid contact with eyes. Wash thoroughly after handling.

b. Apply couplant to both surfaces of inspection area(s).

c. Make sure initial pulse width does not interfere with location of received response. If required, switch position of search units on microdot cables or use different search unit on receiver cable.

d. Use ultrasonic pulse-echo per (WP008 04) to determine if suspect areas are result of skin delaminations. Do pulse-echo inspection on both surfaces to help identify location of flaws causing through transmission unbond response.

12. **Standardization for Inspection of Laminate and Skin to Structure Areas.** Do standardization for laminates and skin to structure areas per (WP008 03), making sure trailing edge of initial pulse is located at less than 1 large division when 0.100 inch FBH response is 80 to 90 percent CRT height.

13. **Inspection Procedures for Laminate and Skin to Structure Areas.** See figures 9 and 10. Inspect laminate and skin to structure areas per (WP008 03) and the following:

**WARNING**

Couplant may cause eye irritation. Avoid contact with eyes. Wash thoroughly after handling.

a. Apply couplant to solid laminate inspection area where laminate thickness is known.

b. Make sure leading edge of back surface response is located at correct location on horizontal baseline when peak amplitude is 80 to 90 percent CRT height.

c. Scan area to be inspected, finger damping back surface response often, as required, to make sure correct response is being received. Finger damp by placing couplant on end of finger and touching opposite surface. As finger touches and is then removed from part surface, reflected response on CRT will move up and down as it is damped, indicating good bond.

d. For inspection responses in addition to those described in (WP008 03), refer to figures 11 and 12.

e. Use pulse-echo mapping techniques per (WP008 03) to determine extent of flaw indication.

**14. Standardization for Inspection of Titanium Skin Bonded to Composite Skin.** See figure 13. Do standardization per (WP008 01), and as specified below:

a. Use two 57A2276 search units.

b. Use P-1 calibration point on 74D111295-1005 graphite epoxy skinned honeycomb core sandwich assembly reference standard.

**15. Inspection Procedures for Titanium Skin Bonded to Composite Skin.** See figures 14 and 15. After standardization, inspect skin to core area of door per (WP008 01), except as below:

a. Use two 57A2276 search units.

**WARNING**

Couplant may cause eye irritation. Avoid contact with eyes. Wash thoroughly after handling.

b. Apply couplant to both surfaces of inspection area(s), and position transducers on titanium skin where core is thickest.

**NOTE**

GAIN may be adjusted by changing FINE GAIN, COARSE GAIN, or by toggling ATTENUATORS.

c. Adjust GAIN (Fine and, if required, Coarse) and FINE SWEEP RANGE so leading edge of received response is at 4 on horizontal baseline and peak amplitude is at 80 to 90 percent of CRT height, see figure 16 CRT 1. Make sure search units are correctly aligned by maximizing response height.

d. Make sure initial pulse width does not interfere with location of received response. If required, switch position of search units on microdot cables or use different search unit on receiver cable.

e. For additional inspection responses, see figure 17.

f. Use ultrasonic resonance inspection per paragraphs 28 and 29 to determine if unbond indications are result of titanium skin to composite skin unbonding.

**16. Standardization for Inspection of Titanium Skin Bonded to Composite Skin Using Fokker Bond Tester.** Do Equipment Settings/Standardization/Setup For Fokker Bond Tester (bond tester) (WP008 06), except as below:

a. Connect 3814 Fokker probe (probe), probe adapter, and cable to bond tester.

b. Turn on bond tester by depressing ON for 1 second.

c. Set bond tester front face settings:

DSP ..... ACTIVATED  
 MODE ..... M  
 S (SWEEP RATE) ..... 1  
 R (SWEEP RANGE) .... 5  
 F (FREQUENCY  
 FINE) ..... 5

### WARNING

Couplant may cause eye irritation. Avoid contact with eyes. Wash thoroughly after handling.

d. Apply couplant to leading edge closure standard.

e. Position probe on leading edge closure standard and use FREQ. FINE and GAIN to get A-scale response of  $0 \pm 1$  KHz and B-scale response of  $100 \pm 5$ , see figure 18.

f. Apply couplant to nearby good composite skin area.

g. Reposition probe over nearby good titanium/composite bondline and observe response similar to figure 18.

#### 17. Inspection Procedure for Titanium Skin Bonded to Composite Skin Using Bond Tester.

### WARNING

Couplant may cause eye irritation. Avoid contact with eyes. Wash thoroughly after handling.

a. Apply couplant to area(s) marked during through Transmission Inspection.

b. Position probe on inspection area and scan making sure index does not exceed 1/2 probe diameter.

c. Inspect bondline by monitoring A and B-scale presentations, see figure 18 for typical responses.

d. Areas that display A-scale response of -3KHz through 3KHz and B-scale response of 90KHz through 110KHz indicate unbond.

e. Mark all unbond areas with aircraft marking pencil and record.

f. Do paragraph 28.

#### 18. ULTRASONIC METHOD USING MXU-715/E ULTRASONIC FLAW DETECTOR.

### Support Equipment Required

Part Number or Type Designation	Nomenclature
1642AS100-1	Ultrasonic Flaw Detector, MXU-715/E, Magnaflux
57A2271 or EQUIVALENT	Microdot to BNC Connecting Cable, 2 Req'd.
57A2276 or EQUIVALENT	0°, 0.500 Dia., 2.25 MHz, Contact, Delay Line, Search Unit, 2 Req'd.
GD0504	0°, 0.25 inch Dia., 5 MHz, Contact, Delay Line, Search Unit
74D110175-1001	Graphite Epoxy Reference Standard Set Containing the Following:
74D111295-1009	Graphite Epoxy Flat Bottom Hole Reference Standard for Laminates up to 0.450 Inch
74D111295-1005	Honeycomb Reference Standard With Graphite Epoxy Skins for Sandwich Assemblies Less Than 1 Inch
74D111295-1003	Honeycomb Reference Standard With Graphite Epoxy Skins for Sandwich Assemblies 1 to 2 Inches

## Support Equipment Required (Continued)

Part Number or Type Designation	Nomenclature
74D111295-1001	Honeycomb Reference Standard With Graphite Epoxy Skins for Sandwich Assemblies 2 Inches or Taller
Model 80	Fokker Bond Tester
3814	Fokker Probe
Yellow Bond Tester Adapter	Probe Adapter Assembly

## Materials Required

### NOTE

Alternate item part numbers are shown indented.

Specification or Part Number	Nomenclature
ULTRAGEL II or EQUIVALENT	Ultrasonic Couplant
M83953-1 or -2	Pencil, Aircraft Marking
PD680TY2 D 1153	Dry Cleaning Solvent Methyl Isobutyl Ketone
CCCC46TY1CL4 MIL-I-25135	Cleaning Cloth Penetrant Emulsifier

### WARNING

Dry cleaning solvent and methyl isobutyl ketone are flammable and toxic to eyes, skin, and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

## 19. Preparation of Part.

a. Clean inspection area(s) of contamination or foreign material using water or, if required, cleaning cloth moistened with dry cleaning solvent or methyl isobutyl ketone.

b. On stabilizer leading edge surface; locate, mark, and identify inspection areas, core splice lines, and boundaries, shown in figures 1 and 2.

### WARNING

Make sure safety precautions have been met for electric, static grounding when using ultrasonic equipment near aircraft fuel cells, oxygen systems, electronic systems, and stores (A1-F18AC-PCM-000).

20. **Standardization for Inspection of Skin to Core Areas.** See figures 3, 4, and 5. For all thicknesses of core, do standardization (WP008 10), and as below:

a. Use two 57A2276 search units.

b. Use P-1 calibration point on applicable 74D111295 graphite epoxy skinned honeycomb core sandwich assembly reference standard, see figure 2 for core thicknesses.

21. **Inspection Procedure for Skin to Core Areas.** See figures 6, 7, and 8. After standardization, inspect skin to core area of door per (WP008 10), except as specified below:

a. Use two 57A2276 search units

### WARNING

Couplant may cause eye irritation. Avoid contact with eyes. Wash thoroughly after handling.

b. Apply couplant to both surfaces of inspection area(s).

c. Make sure initial pulse width does not interfere with location of received response. If required, switch position of search units on microdot cables or use different search unit on receiver cable.

d. Use ultrasonic pulse-echo per (WP008 13) to determine if suspect areas are result of skin delaminations. Do pulse-echo inspection on both surfaces to help identify location of flaws causing through transmission unbond response.

22. **Standardization for Inspection of Laminate and Skin to Structure Areas.** Do standardization for laminates and skin to structure areas per (WP008 12), making sure trailing edge of initial pulse is located at less than 1 large division when 0.100 inch FBH response is 80 to 90 percent CRT height.

23. **Inspection Procedures for Laminate and Skin to Structure Areas.** See figures 9 and 10. Inspect laminate and skin to structure areas per (WP008 12) and the following:

## WARNING

Couplant may cause eye irritation. Avoid contact with eyes. Wash thoroughly after handling.

a. Apply couplant to solid laminate inspection area where laminate thickness is known.

b. Make sure leading edge of back surface response is located at correct location on horizontal baseline when peak amplitude is 80 to 90 percent CRT height.

c. Scan area to be inspected, finger damping back surface response often, as required, to make sure correct response is being received. Finger damp by placing couplant on end of finger and touching opposite surface. As finger touches and is then removed from part surface, reflected response on CRT will move up and down as it is damped, indicating good bond.

d. For inspection responses in addition to those described in (WP008 12), refer to figures 11 and 12.

e. Use pulse-echo mapping techniques per (WP008 12) to determine extent of flaw indication.

24. **Standardization for Inspection of Titanium Skin Bonded to Composite Skin.** See figure 13. Do standardization per (WP008 10), and as specified below:

a. Use two 57A2276 search units.

b. Use P-1 calibration point on 74D111295-1005 graphite epoxy skinned honeycomb core sandwich assembly reference standard.

25. **Inspection Procedures for Titanium Skin Bonded to Composite Skin.** See figures 14 and 15. After standardization, inspect skin to core area of door per (WP008 10), except as below:

a. Use two 57A2276 search units.

## WARNING

Couplant may cause eye irritation. Avoid contact with eyes. Wash thoroughly after handling.

b. Apply couplant to both surfaces of inspection area(s), and position transducers on titanium skin where core is thickest.

c. Adjust GAIN (Fine and, if required, Coarse) and FINE HORIZONTAL SWEEP LENGTH so leading edge of received response is at 4 on horizontal baseline and peak amplitude is at 80 to 90 percent of CRT height, see figure 16 CRT 1. Make sure search units are correctly aligned by maximizing response height.

d. Make sure initial pulse width does not interfere with location of received response. If required, switch position of search units on microdot cables or use different search unit on receiver cable.

e. For additional inspection responses, see figure 17.

f. Use ultrasonic resonance inspection per paragraphs 28 and 29 to determine if unbond indications are result of titanium skin to composite skin unbonding.

26. **Standardization for Inspection of Titanium Skin Bonded to Composite Skin Using Fokker Bond Tester.** Do Equipment Settings/Standardization/Setup For Fokker Bond Tester (bond tester) (WP008 06), except as below:

a. Connect 3814 Fokker probe (probe), probe adapter, and cable to bond tester.

b. Turn on bond tester by depressing ON for 1 second.

- c. Set bond tester front face settings:

DSP .....	ACTIVATED
MODE .....	M
S (SWEEP RATE) .....	1
R (SWEEP RANGE) ....	5
F (FREQUENCY FINE) .....	5

**WARNING**

Couplant may cause eye irritation. Avoid contact with eyes. Wash thoroughly after handling.

- d. Apply couplant to leading edge closure standard.

e. Position probe on leading edge closure standard and use FREQ. FINE and GAIN to get A-scale response of  $0 \pm 1$  KHz and B-scale response of  $100 \pm 5$ , see figure 18.

f. Apply couplant to nearby good composite skin area.

g. Reposition probe over nearby good titanium/composite bondline and observe response similar to figure 18.

#### 27. Inspection Procedure for Titanium Skin Bonded to Composite Skin Using Bond Tester.

**WARNING**

Couplant may cause eye irritation. Avoid contact with eyes. Wash thoroughly after handling.

a. Apply couplant to area(s) marked during through Transmission Inspection.

b. Position probe on inspection area and scan making sure index does not exceed 1/2 probe diameter.

c. Inspect bondline by monitoring A and B-scale presentations, see figure 18 for typical responses.

d. Areas that display A-scale response of -3KHz through 3KHz and B-scale response of 90KHz through 110KHz indicate unbond.

e. Mark all unbond areas with aircraft marking pencil and record.

**WARNING**

Dry cleaning solvent and methyl isobutyl ketone are flammable and toxic to eyes, skin and respiratory tract. Skin/eye protection required. Avoid repeated/prolonged contact. Use only in well ventilated areas. Keep away from open flames or other sources of ignition.

28. **POST INSPECTION CLEANING AND CORROSION CONTROL.** Clean couplant and markings from flap using water, or if required, cleaning cloth moistened with dry cleaning solvent or methyl isobutyl ketone.



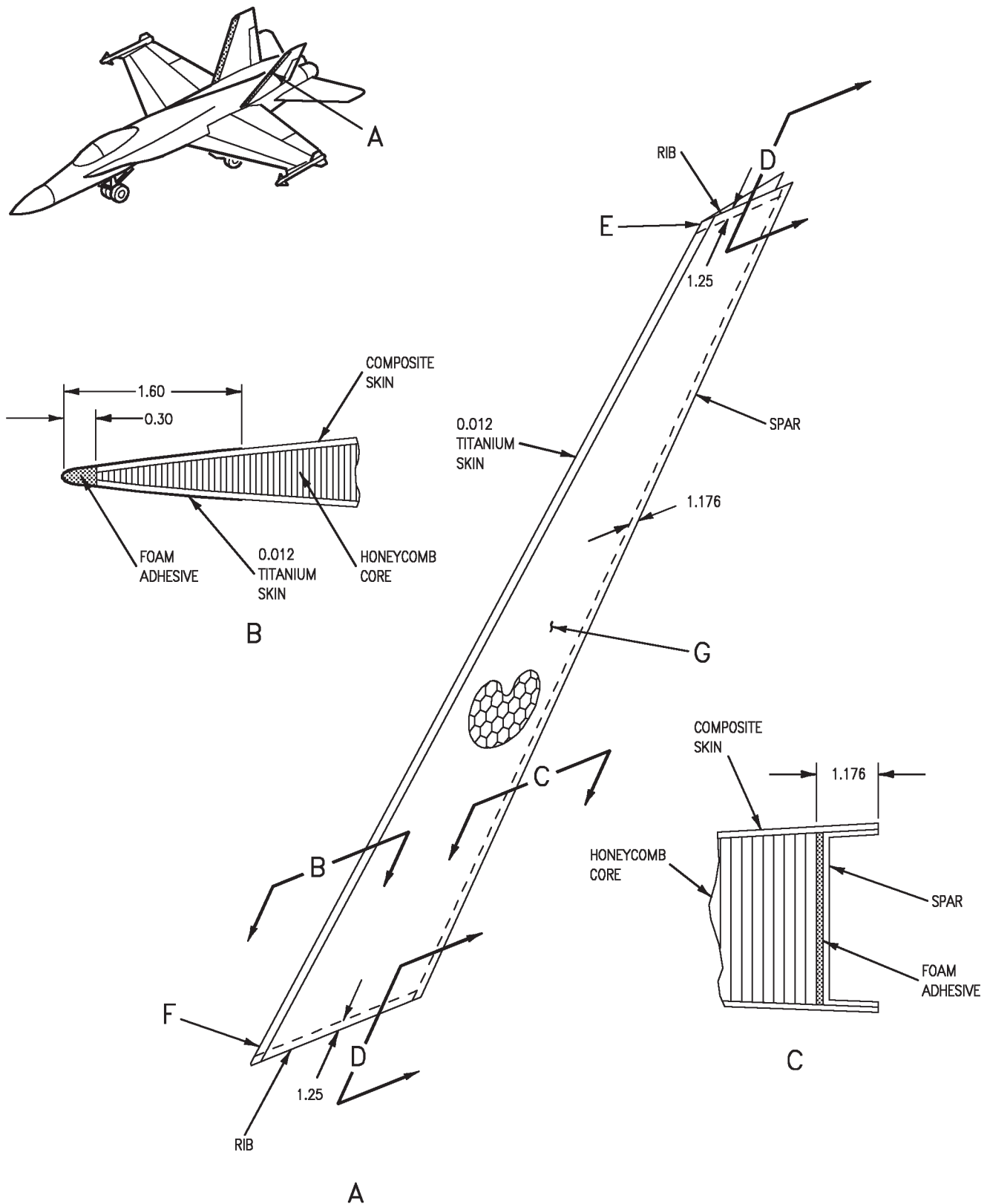
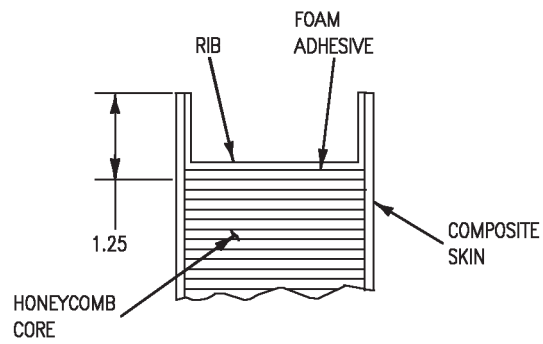
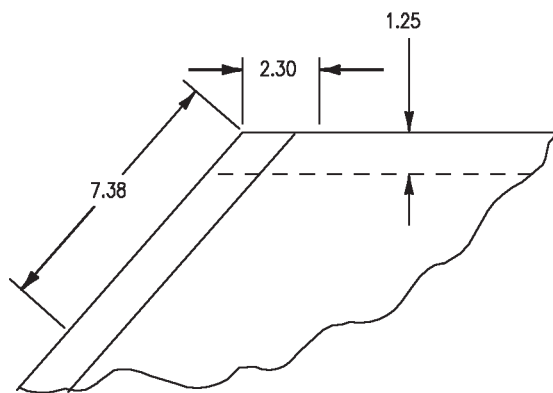


Figure 1. Structure and Skin Thickness (Sheet 1)

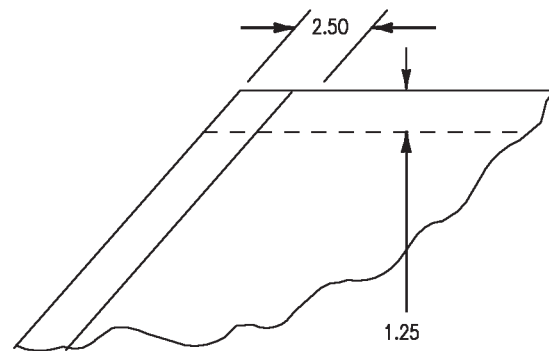


TYPICAL  
D

## LEGEND

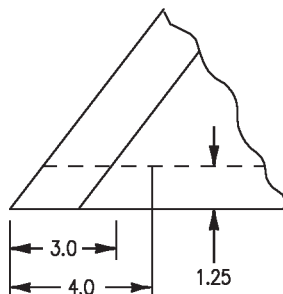


161366 AND UP

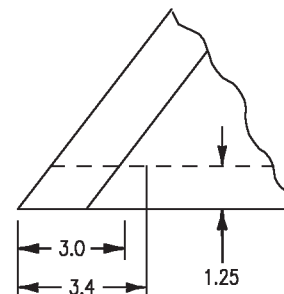


161353 THRU 161365

E



161366 AND UP



161353 THRU 161365

F

Figure 1. Structure and Skin Thickness (Sheet 2)



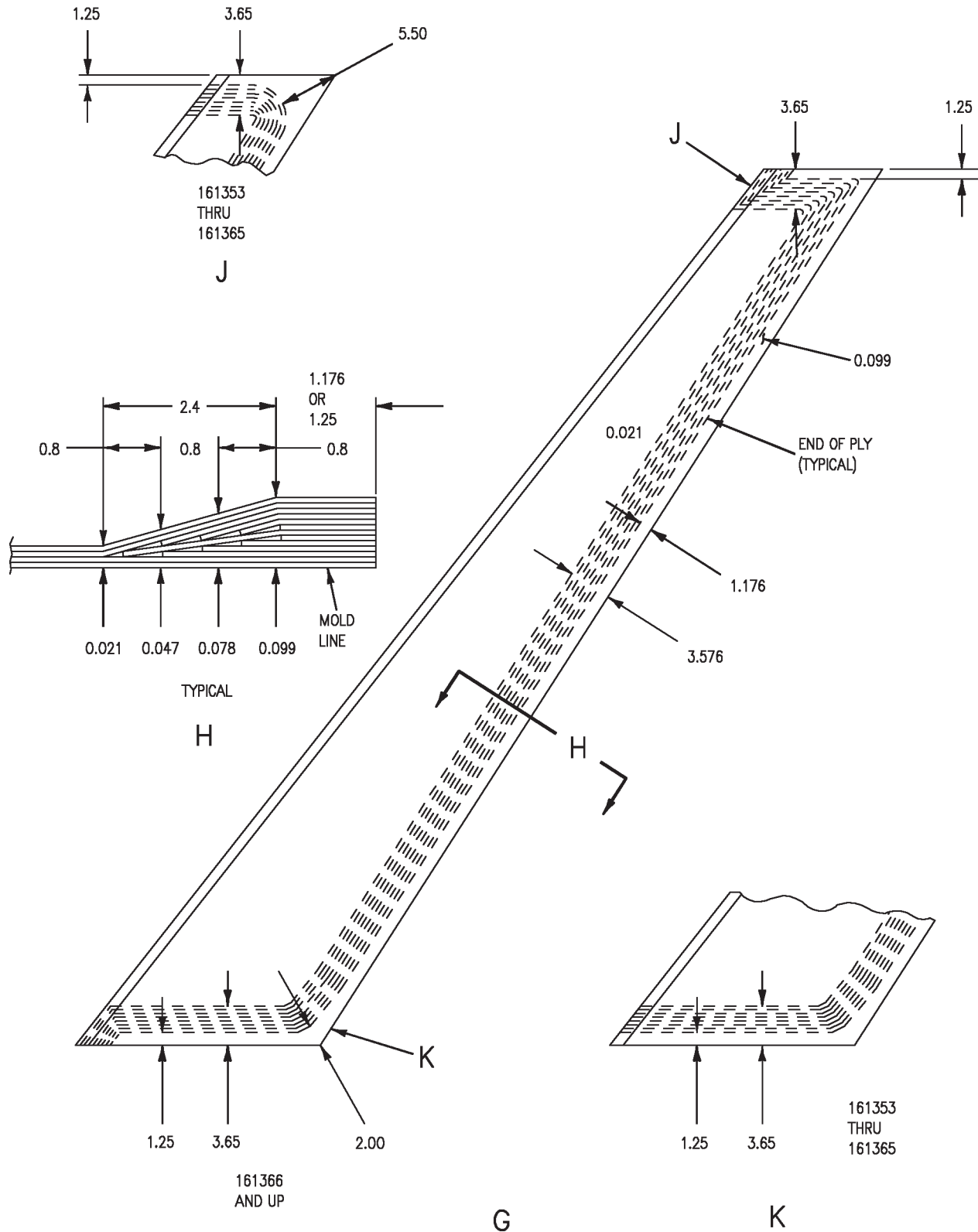


Figure 1. Structure and Skin Thicknesses (Sheet 3)

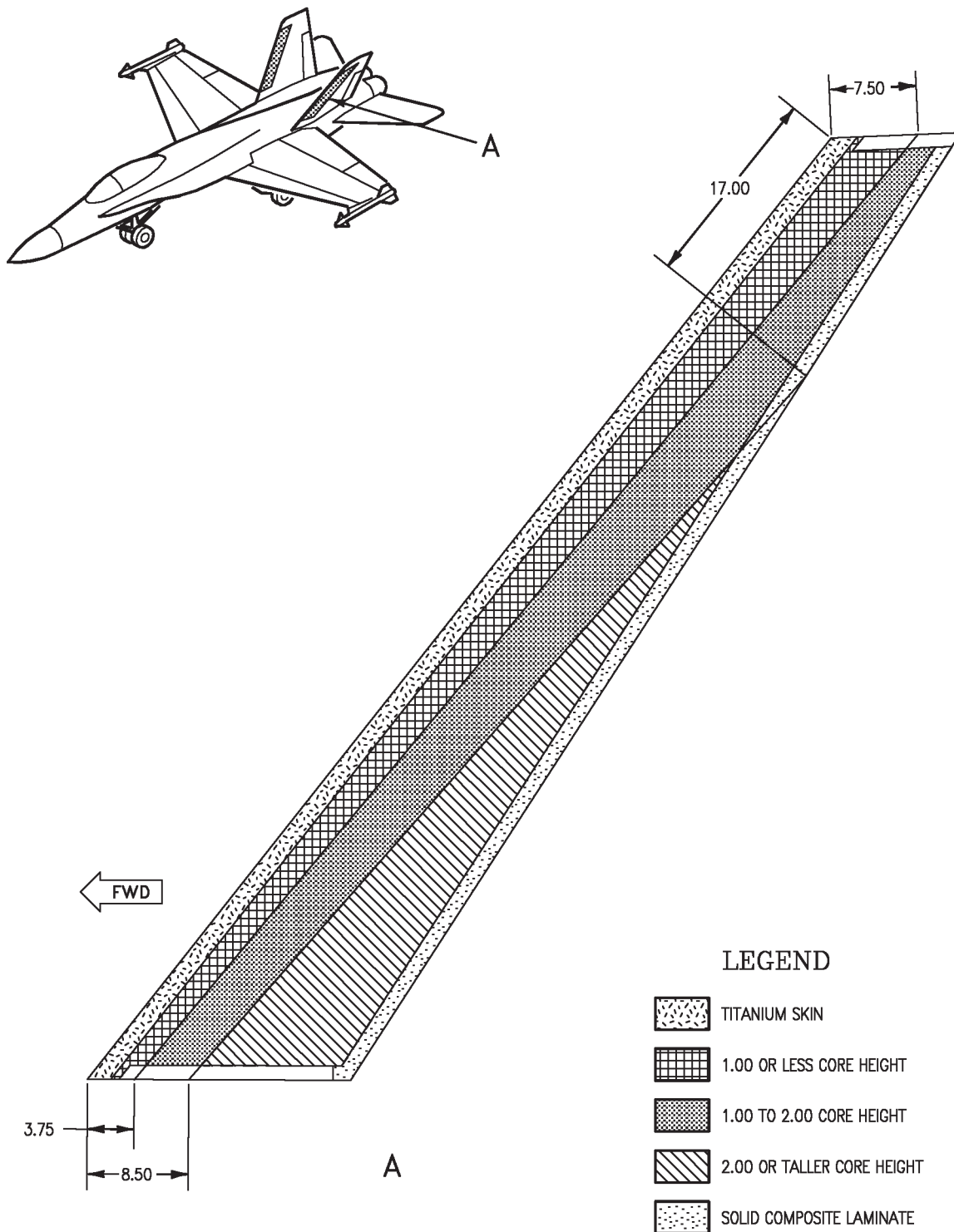
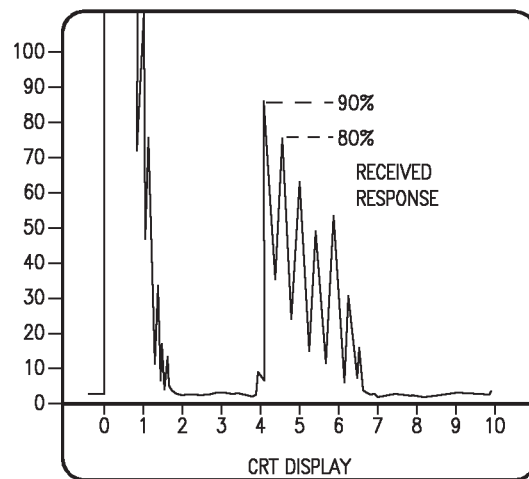
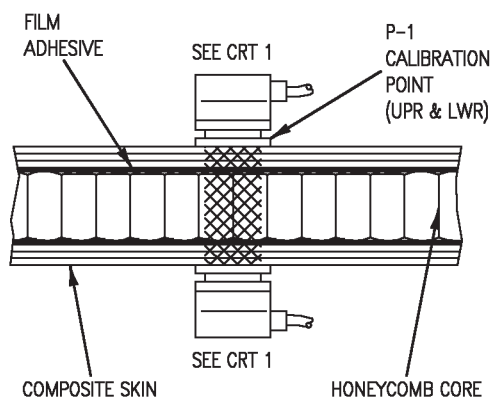


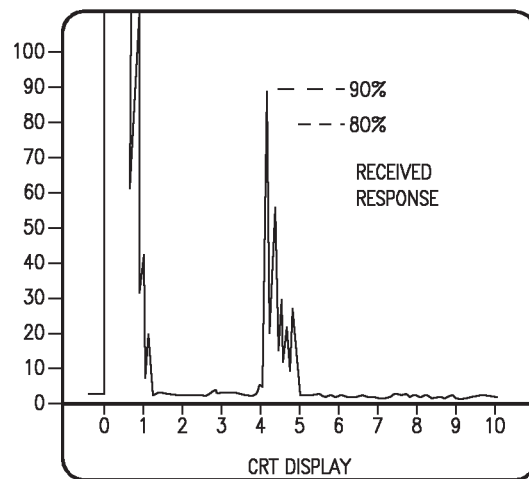
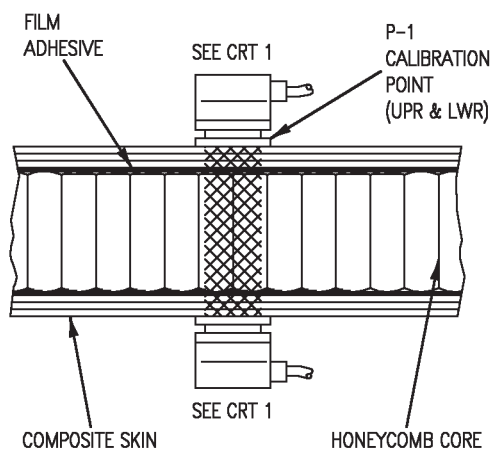
Figure 2. Bonded Honeycomb Core Height Areas



CRT 1

LEADING EDGE OF RECEIVED RESPONSE  
LOCATED AT 4 ON THE HORIZONTAL BASELINE.

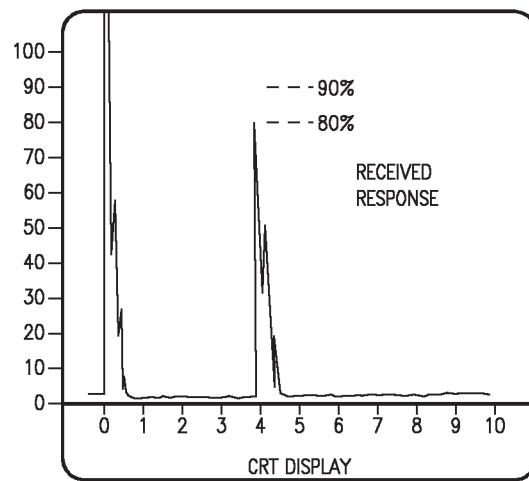
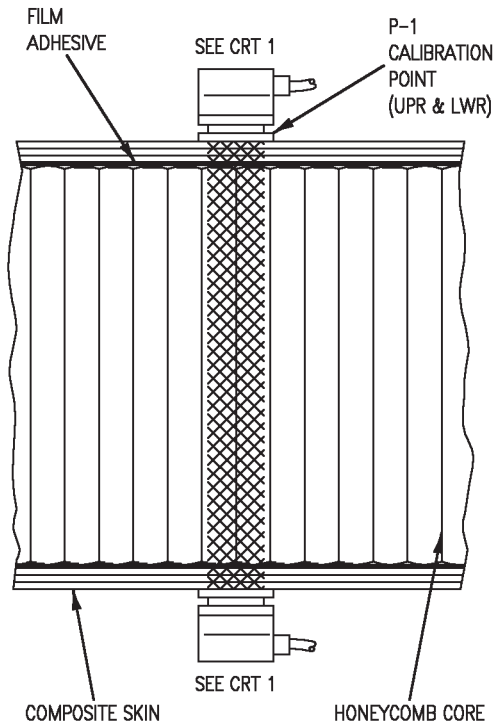
**Figure 3. Standardization on One Half Inch Tall Graphite Epoxy Skinned  
Honeycomb Core Sandwich Assembly Reference Standard**



CRT 1

LEADING EDGE OF RECEIVED RESPONSE  
LOCATED AT 4 ON THE HORIZONTAL BASELINE.

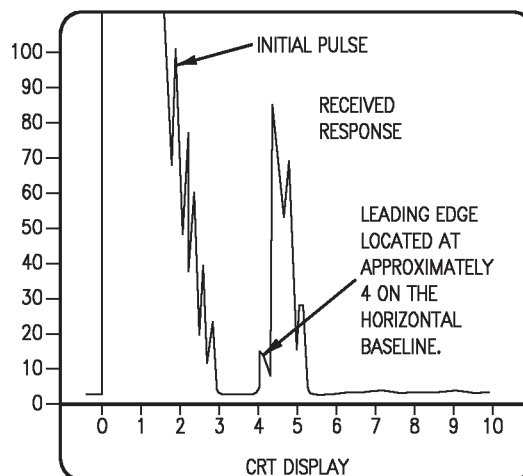
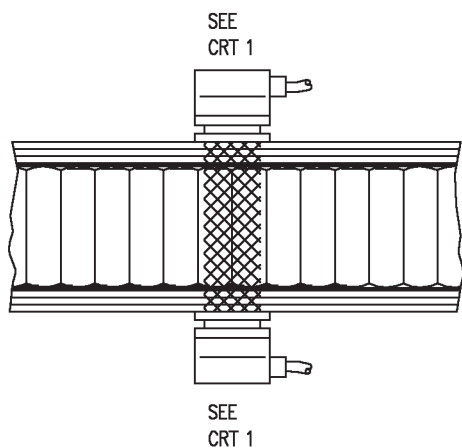
**Figure 4. Standardization on One Inch Tall Graphite Epoxy Skinned Honeycomb Core Sandwich Assembly Reference Standard**



CRT 1

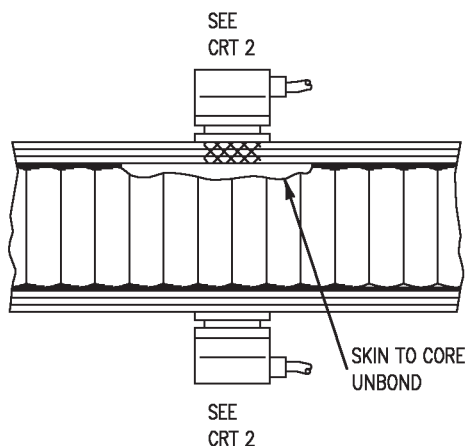
LEADING EDGE OF RECEIVED RESPONSE  
LOCATED AT 4 ON THE HORIZONTAL BASELINE.

**Figure 5. Standardization on Three Inch Tall Graphite Epoxy Skinned Honeycomb Core Sandwich Assembly Reference Standard**



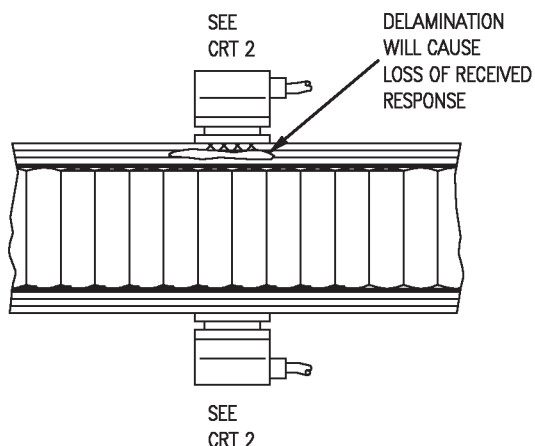
**CRT 1**

TYPICAL SKIN TO CORE AREA  
GOOD BOND RESPONSE.

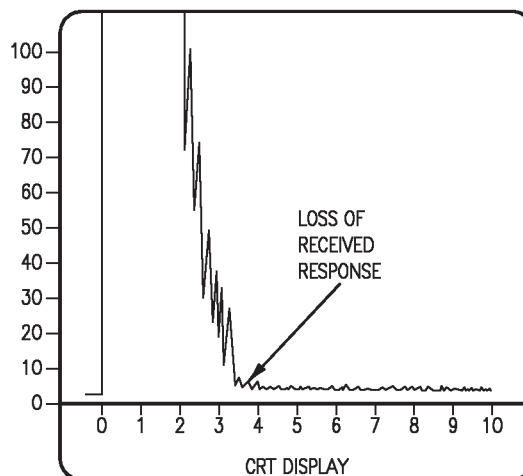


SEE  
CRT 2

OR



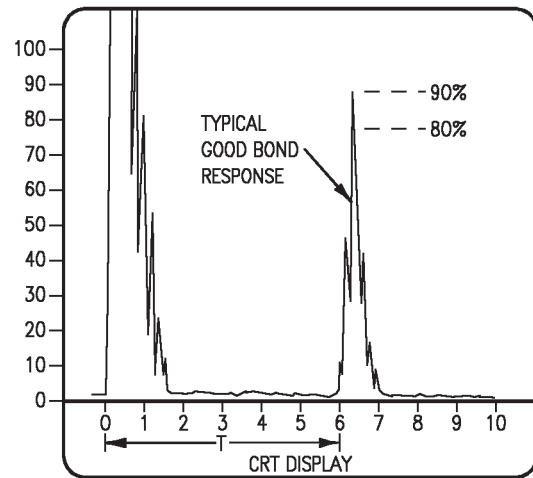
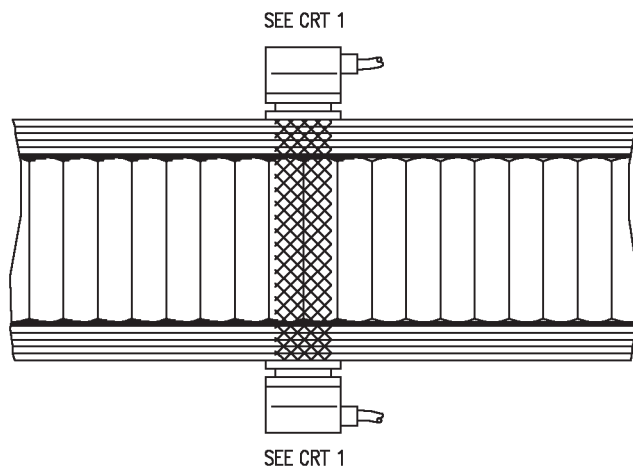
SEE  
CRT 2



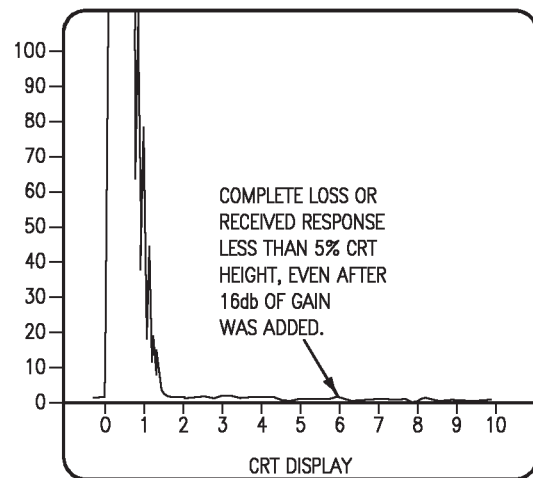
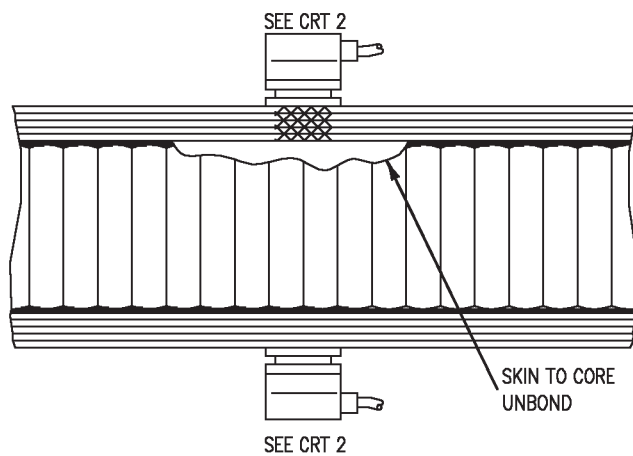
**CRT 2**

TYPICAL SKIN TO CORE AREA  
UNBOND RESPONSE.

**Figure 6. One Inch or Less Honeycomb Core Area Inspection Responses**



CRT 1



CRT 2

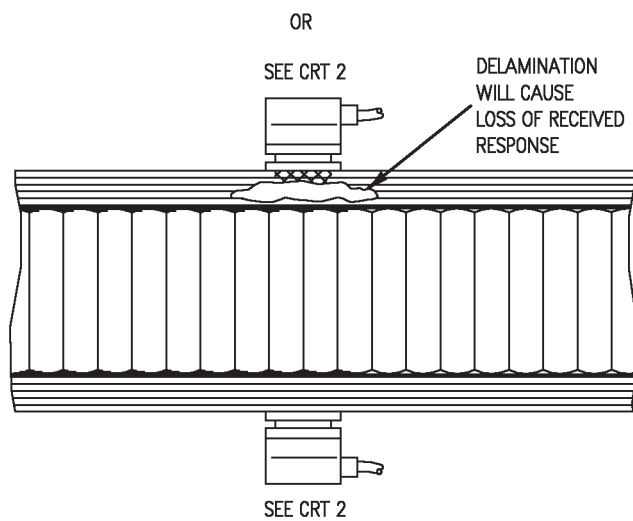
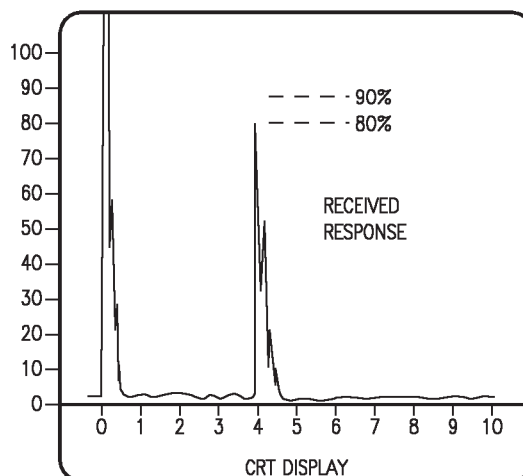
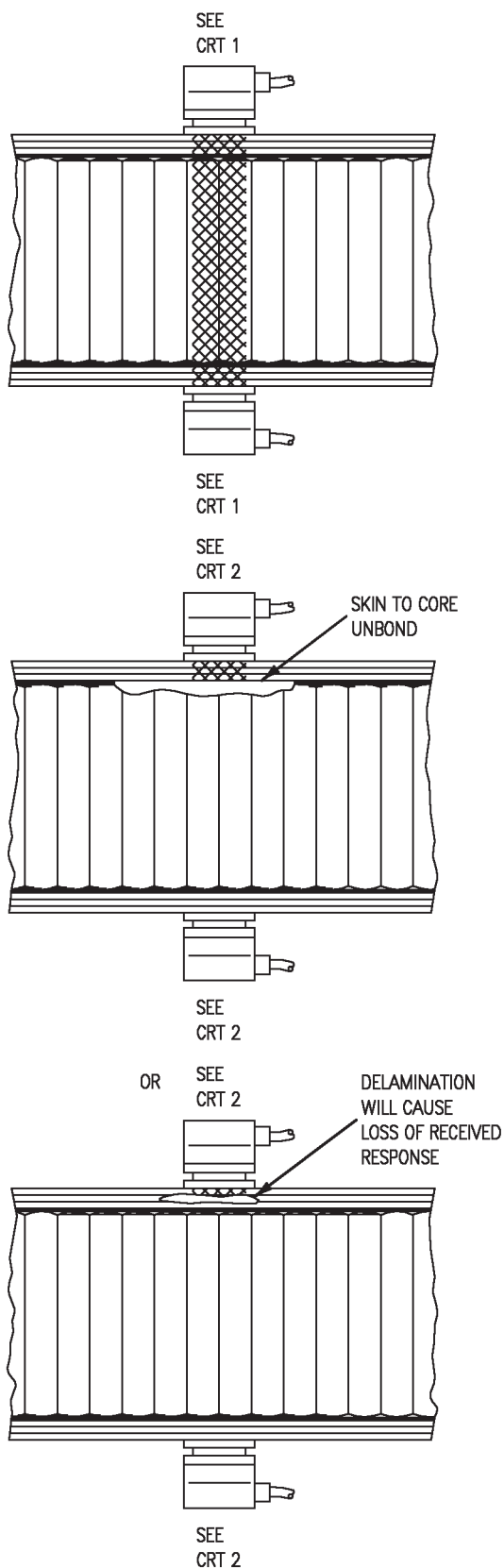
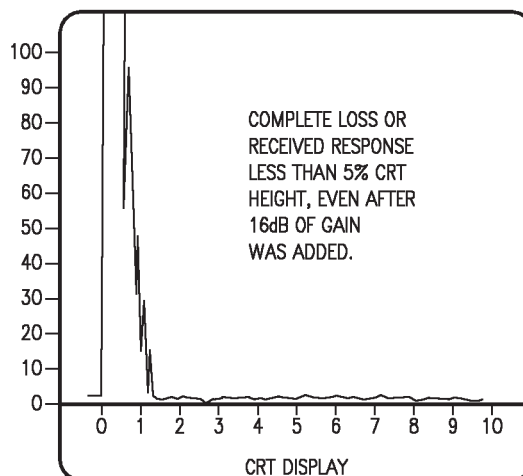


Figure 7. One to Two Inch Honeycomb Core Area Inspection Responses



CRT 1

LEADING EDGE OF RECEIVED RESPONSE  
LOCATED AT 4 ON THE HORIZONTAL  
BASELINE.



CRT 2

Figure 8. Two Inch or Taller Honeycomb Core Area Inspection Responses



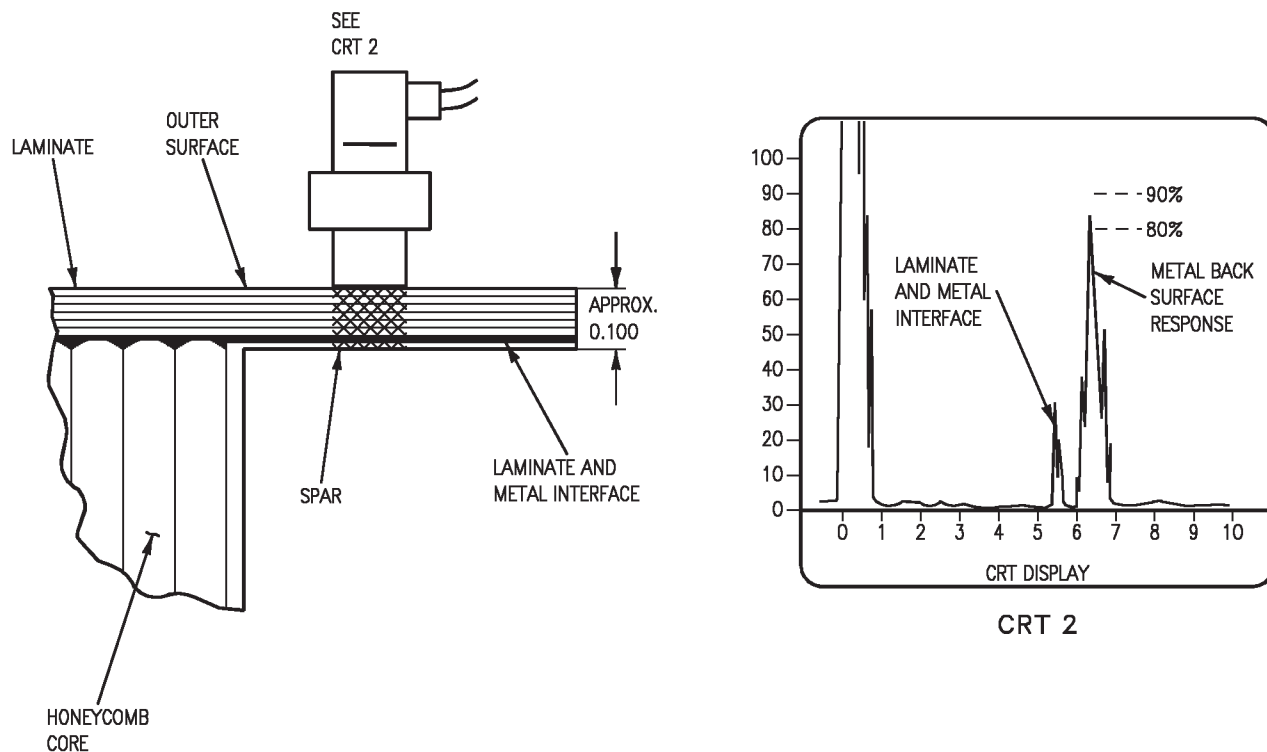
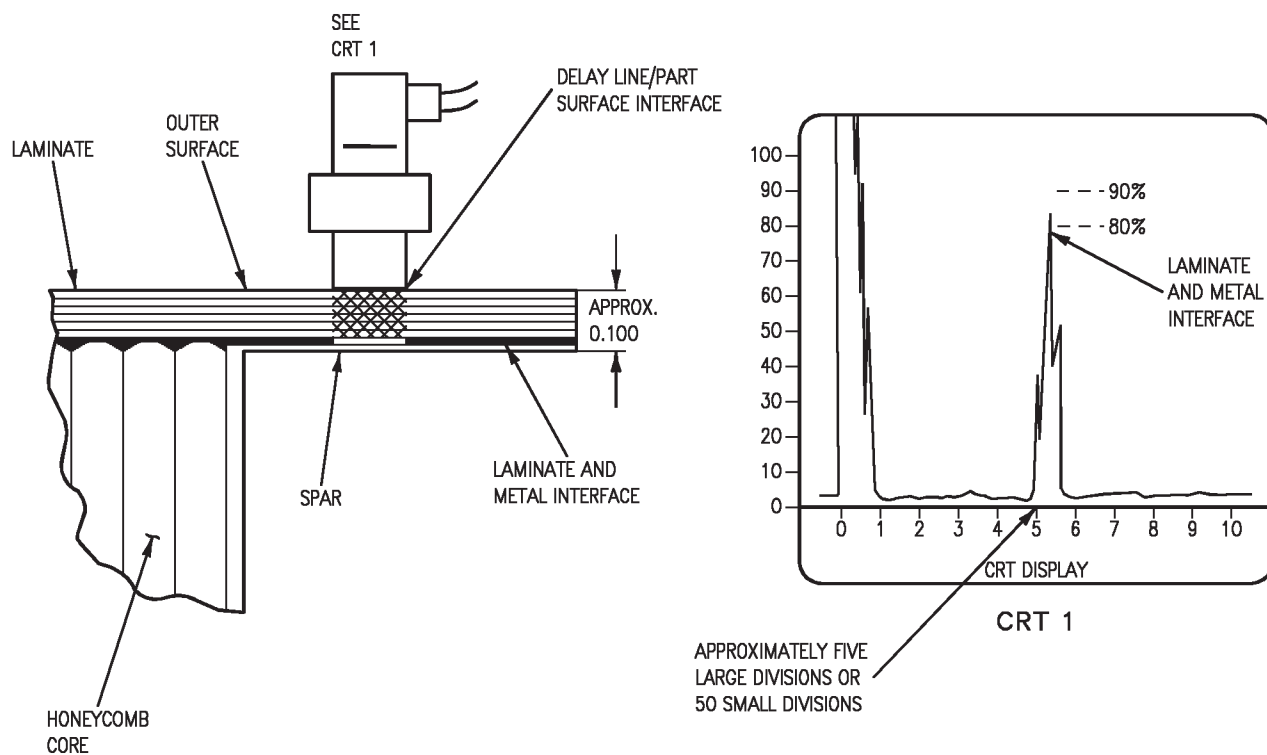
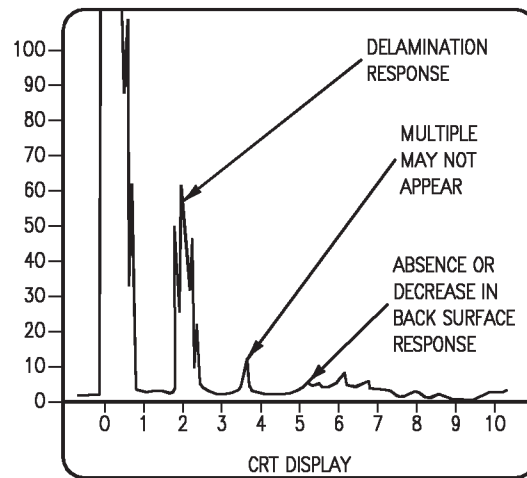
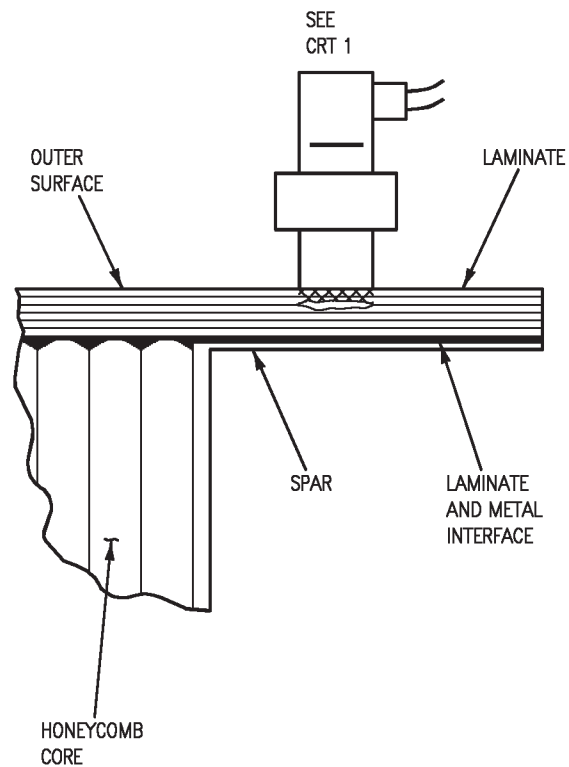


Figure 9. Typical Allowable Solid Laminate Inspection Responses



CRT 1

Figure 10. Example of Delamination Response in Solid Laminate Area

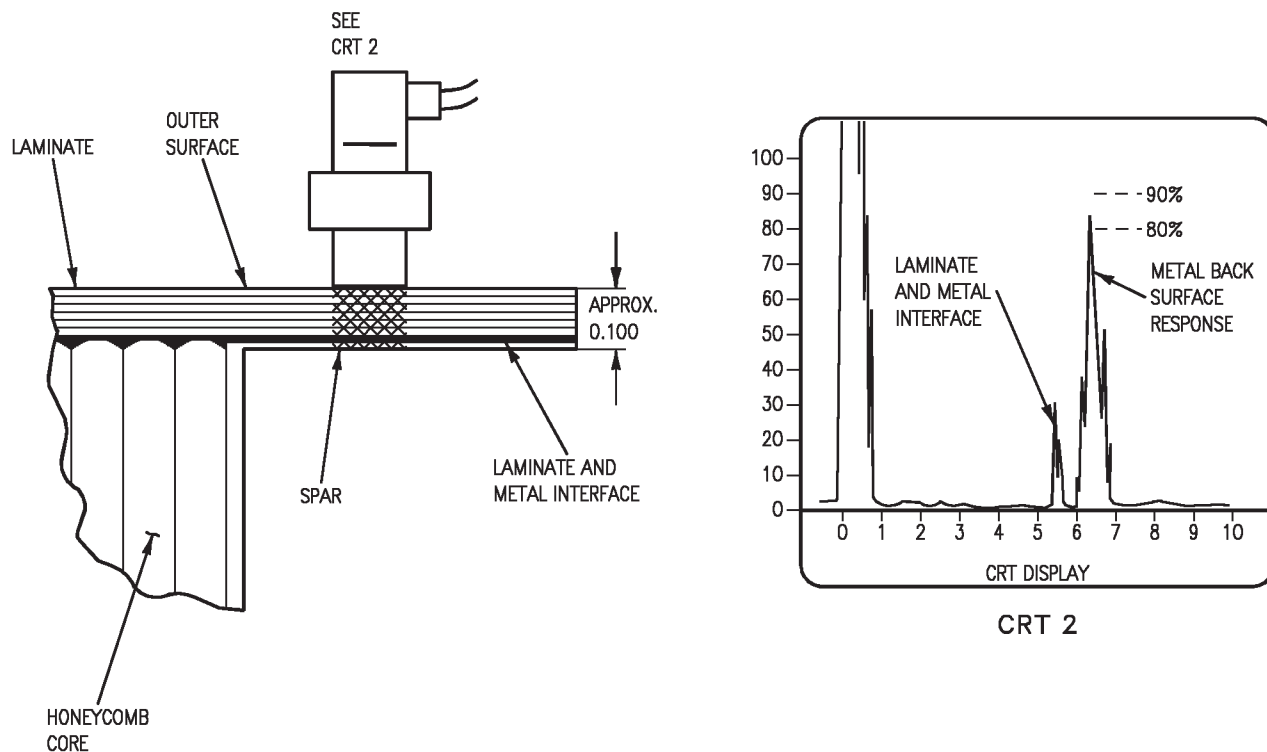
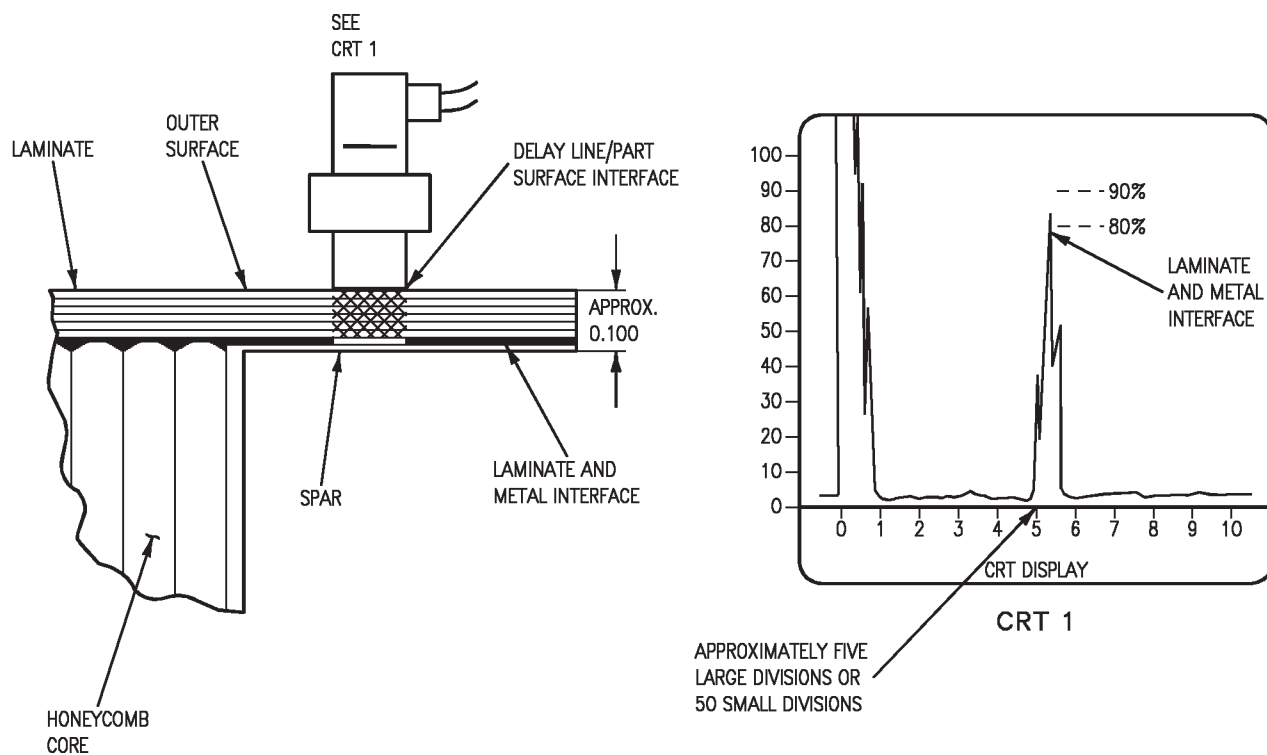
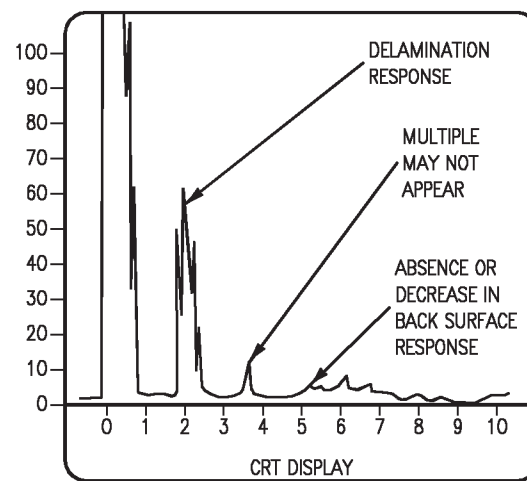
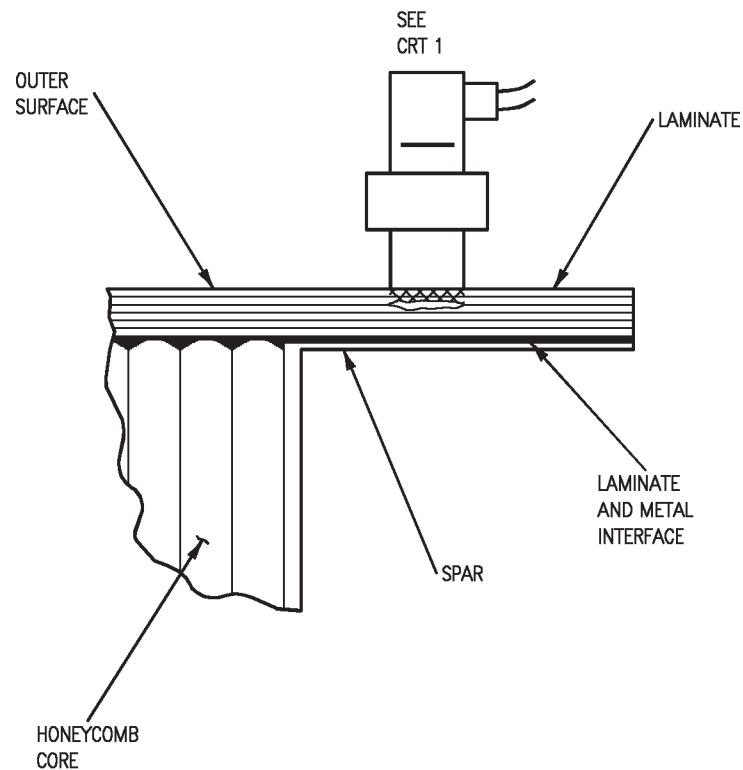


Figure 11. Additional Solid Laminate Inspection Responses



CRT 1

**Figure 12. Example of Delamination Response in Solid Laminate Area Over Skin to Metal Bond**

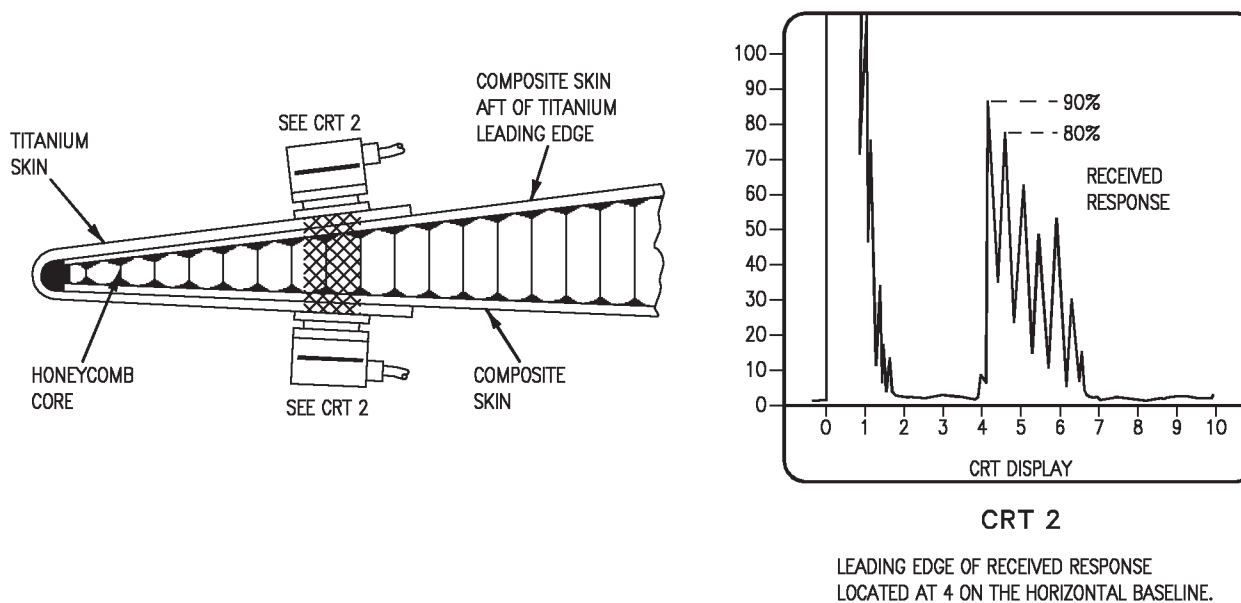
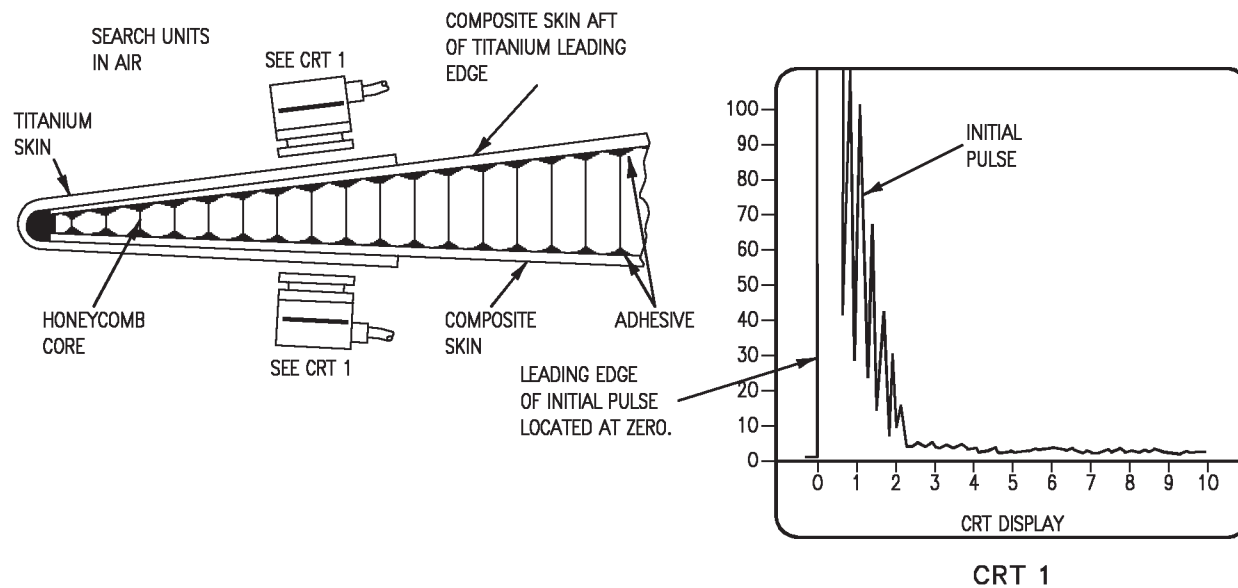
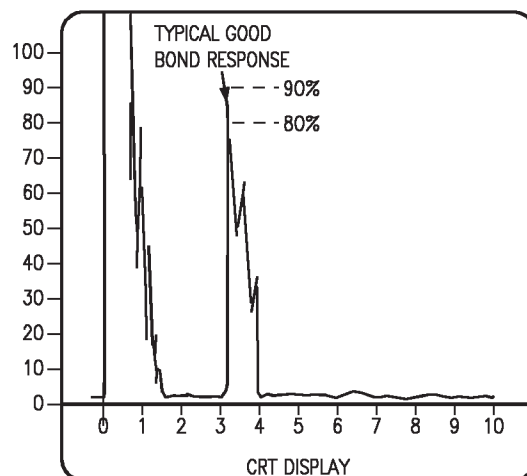
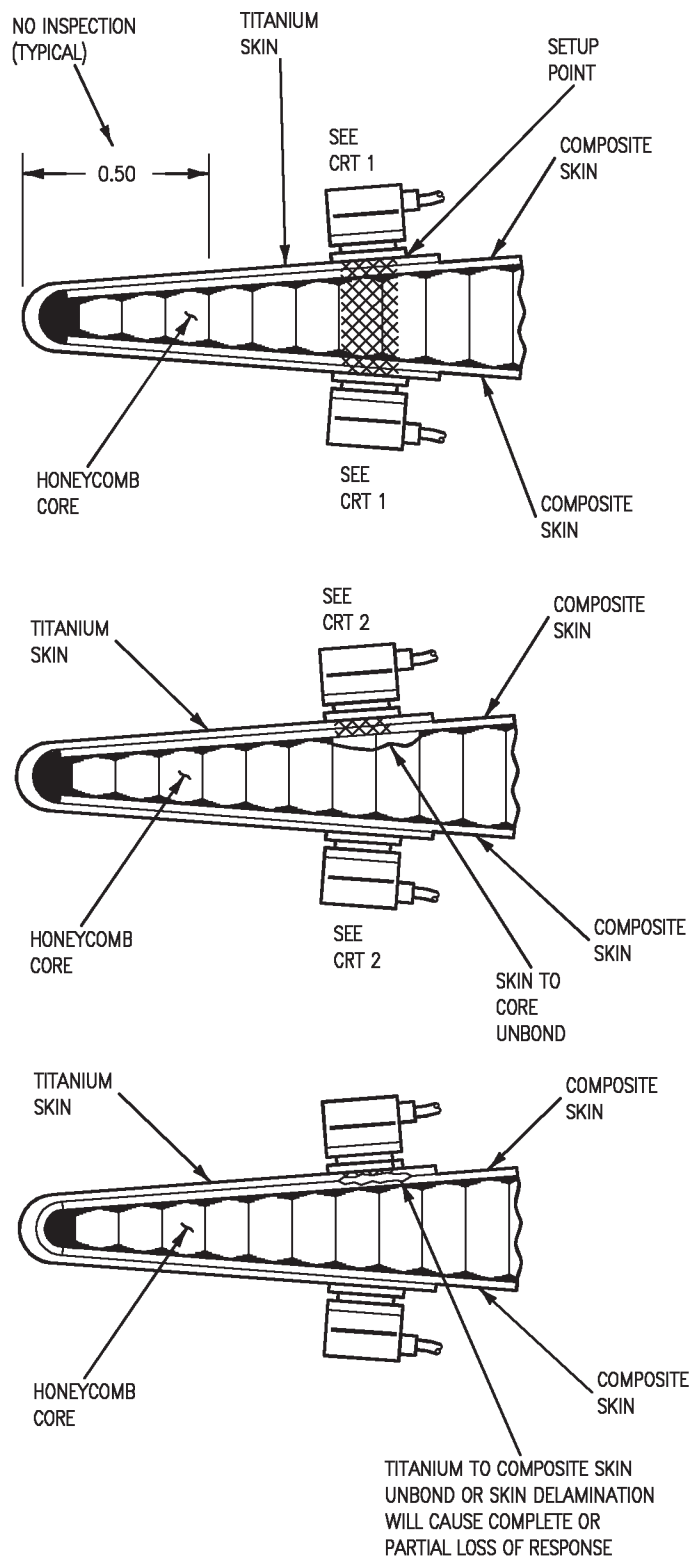
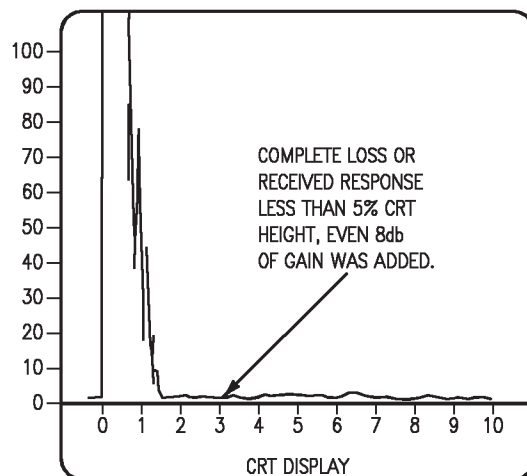


Figure 13. Setup For Inspection of Titanium Skin Area of Leading Edge



CRT 1



CRT 2

Figure 14. Titanium Skin Inspection Responses

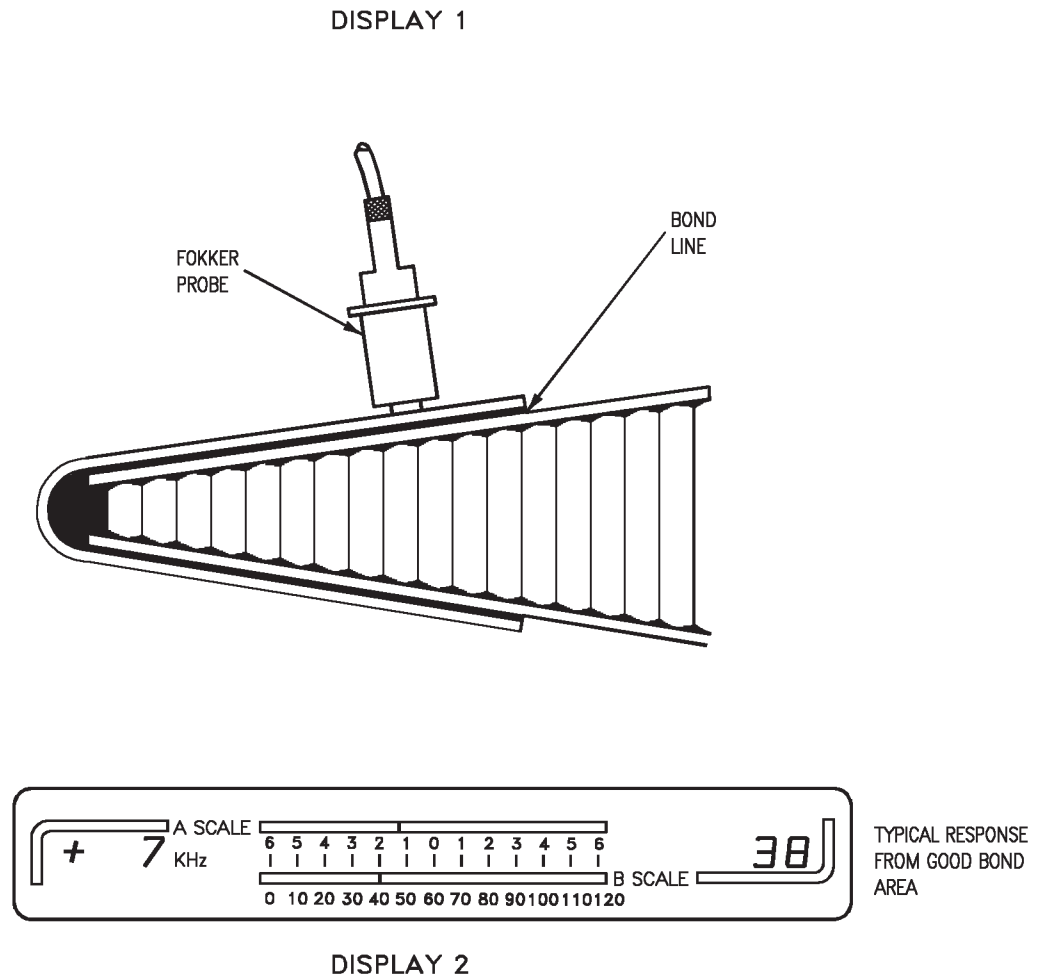
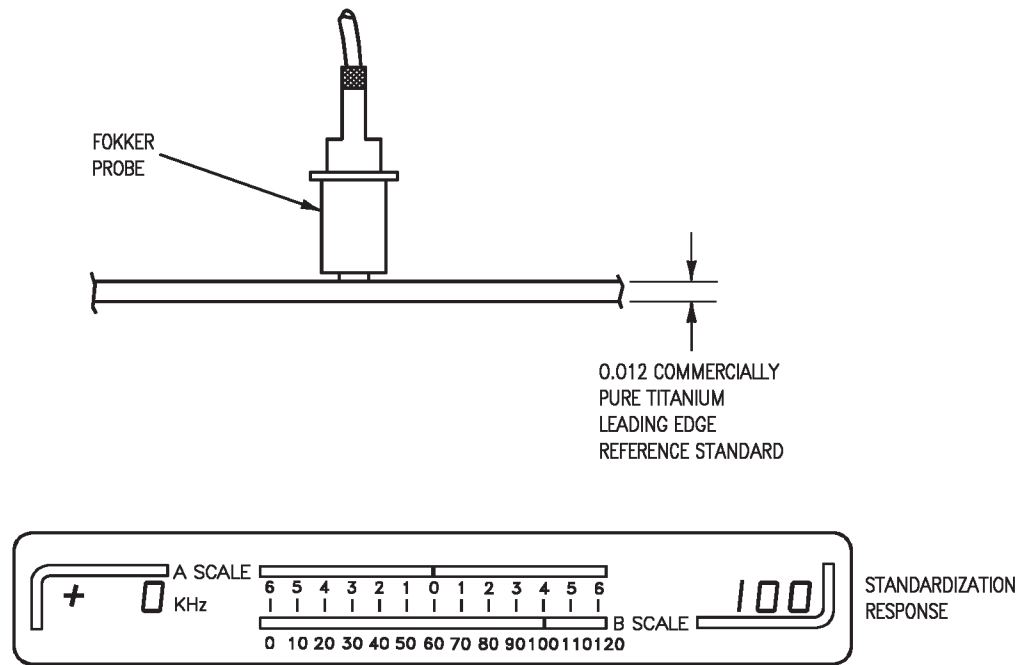
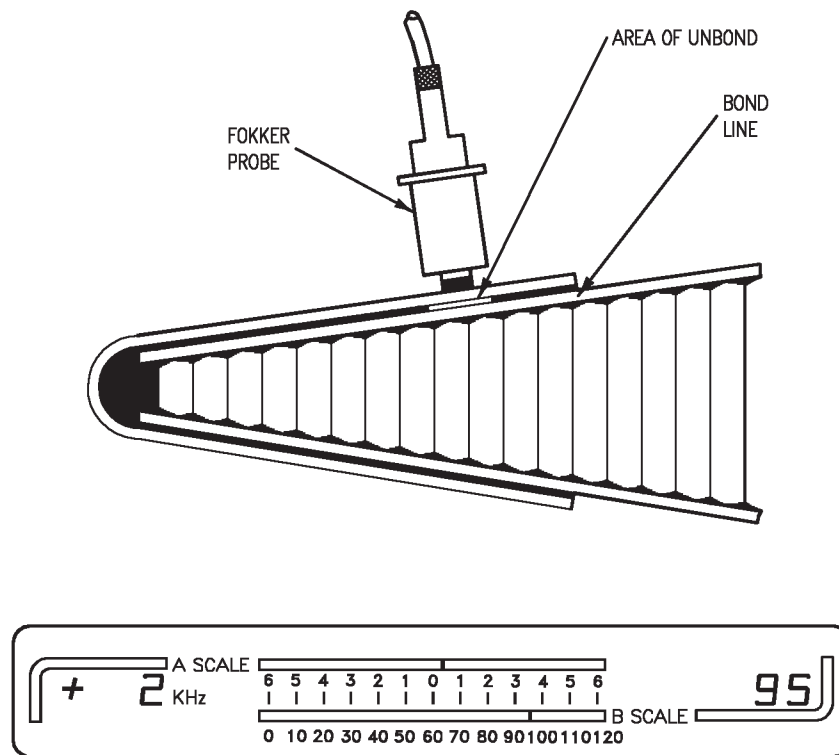


Figure 15. Ultrasonic Resonance Inspection Responses (Sheet 1)

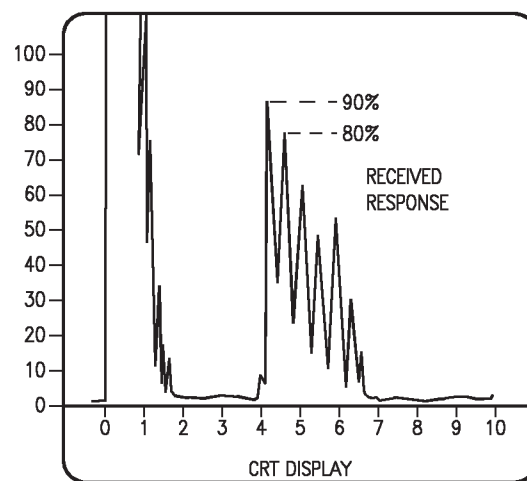
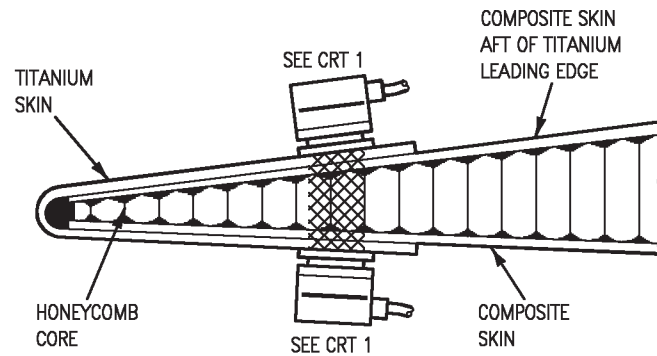


TYPICAL RESPONSE FROM  
TITANIUM CLOSURE UNBOND

DISPLAY 3

Figure 15. Ultrasonic Resonance Inspection Responses (Sheet 2)

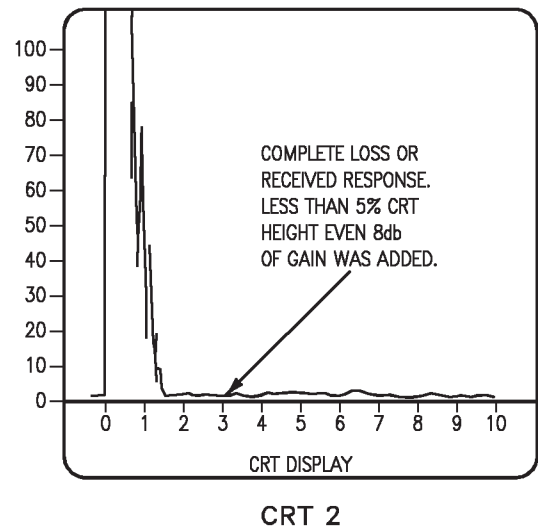
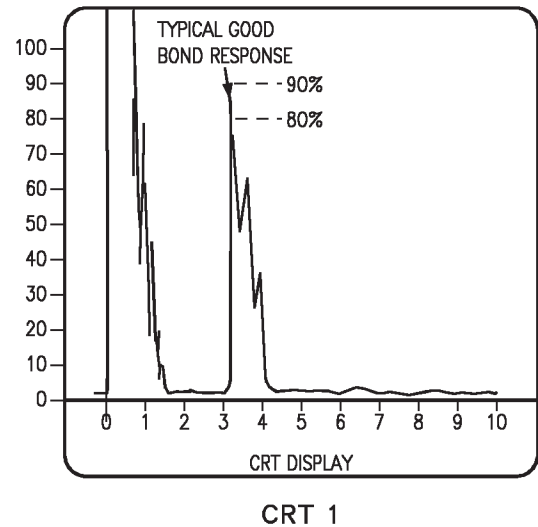
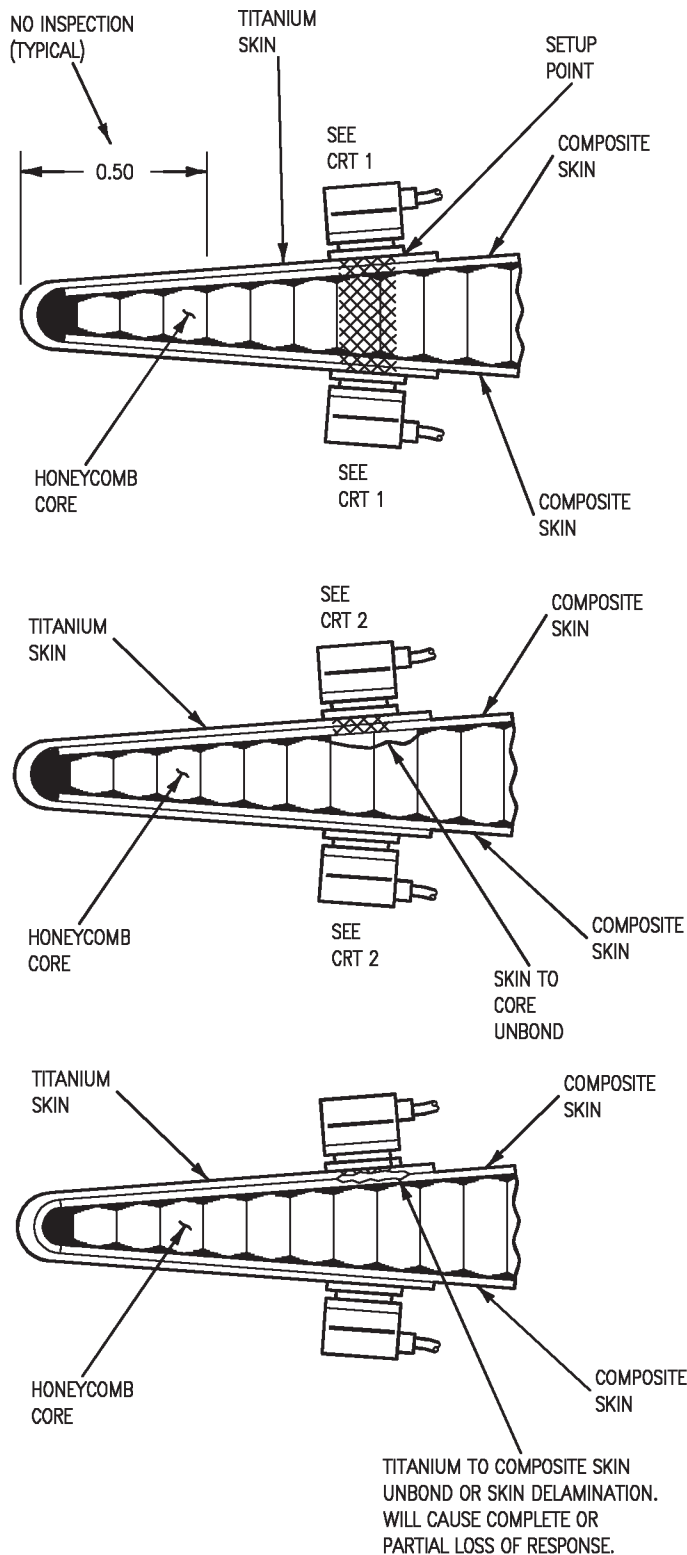




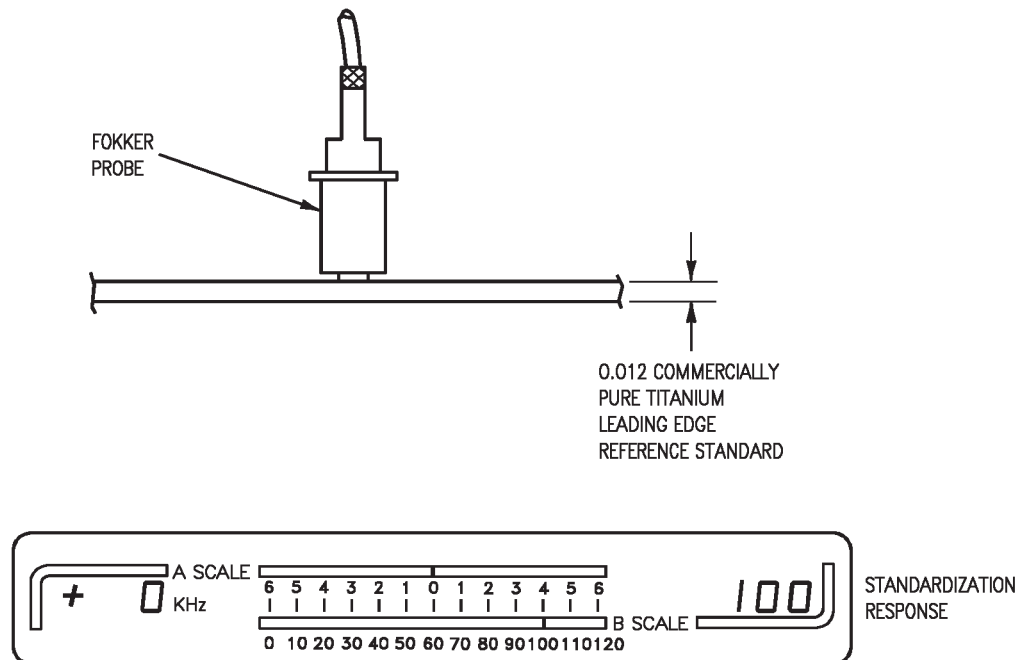
CRT 1

LEADING EDGE OF RECEIVED RESPONSE  
LOCATED AT 4 ON THE HORIZONTAL BASELINE.

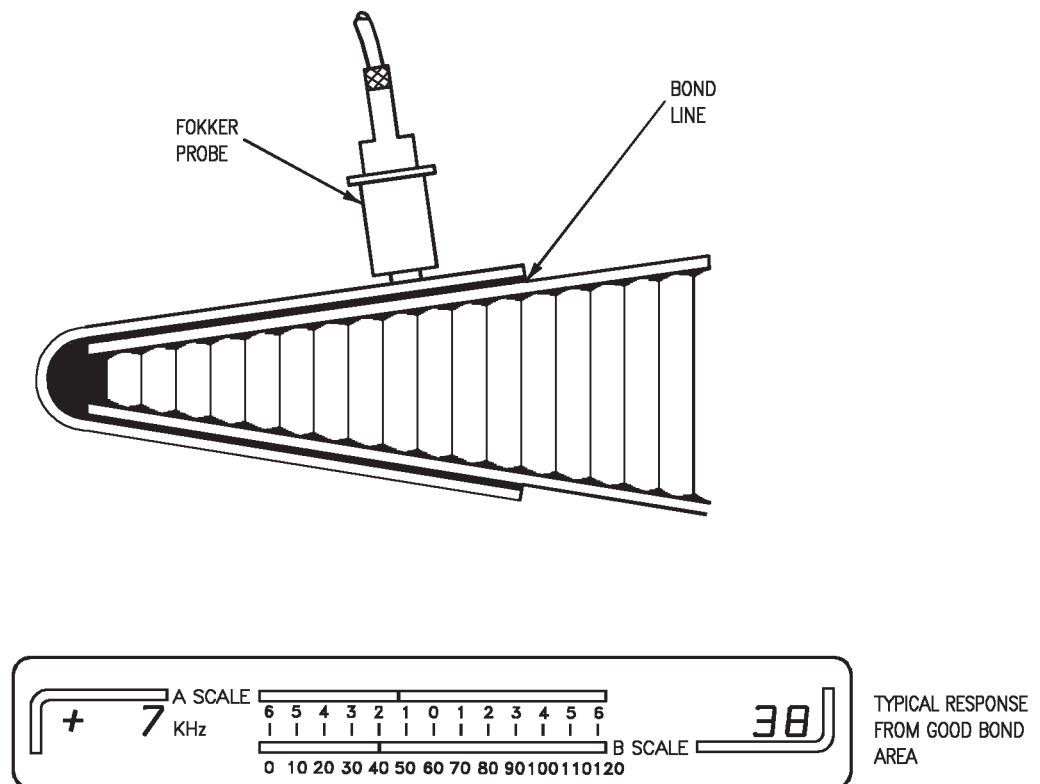
Figure 16. Inspection of Titanium Skin Area of Leading Edge



**Figure 17. Titanium Skin Inspection Responses**



DISPLAY 1



DISPLAY 2

Figure 18. Ultrasonic Resonance Inspection Responses Using Fokker Bond Tester  
(Sheet 1)

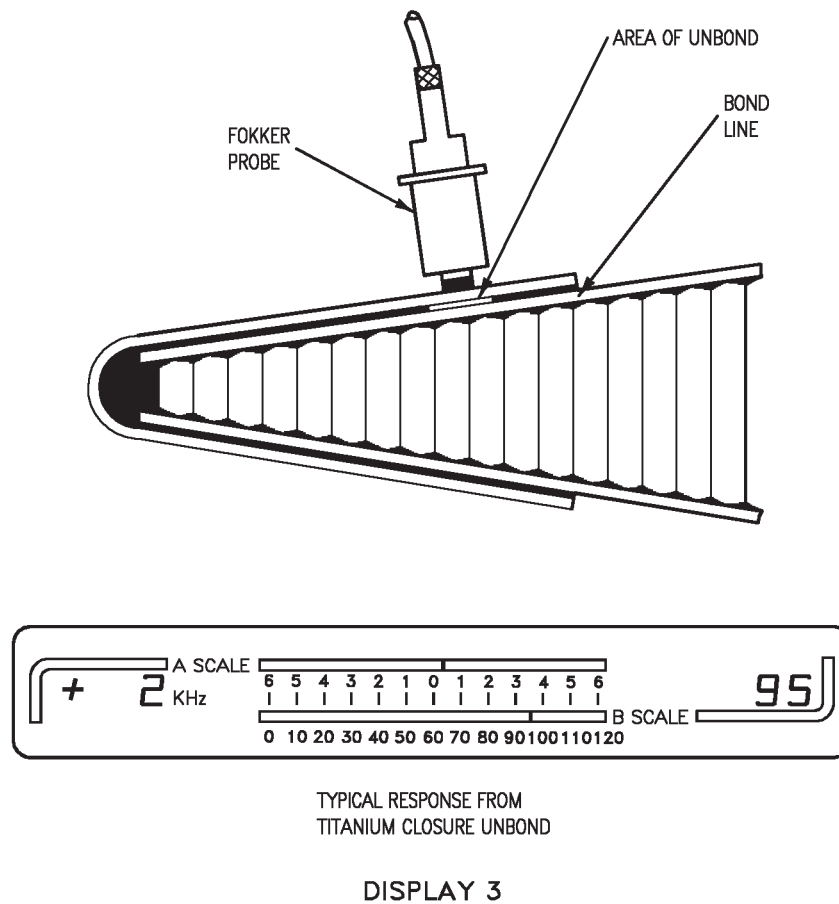


Figure 18. Ultrasonic Resonance Inspection Responses Using Fokker Bond Tester  
(Sheet 2)